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COMPTON'S PICTURED ENCYCLOPEDIA AND FACT-INDEX

Interesting · Accurate · Up-to-date

TO INSPIRE AMBITION
TO STIMULATE THE IMAGINATION, TO PROVIDE THE
INQUIRING MIND WITH ACCURATE
INFORMATION TOLD IN AN INTERESTING
STYLE, AND THUS LEAD INTO
BROADER FIELDS OF KNOWLEDGE,
SUCH IS THE PURPOSE OF
THIS WORK



Volume 2

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COMPTON'S PICTURED ENCYCLOPEDIA

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Here and There in This Volume

AT ODD TIMES when you are just looking for something interesting to read, with out any special plan in mind this list will help you. With this as a guide, you may visit faraway countries, watch people at their work and play, meet famous persons of ancient and modern times, review history's most brilliant incidents, explore the marvels of nature and science, play games—in short, find whatever suits your fancy of the moment. This list is not intended to serve as a table of contents, an index, or a study guide. For these purposes consult the Fact Index and the Reference Outlines.

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KEY TO PRONUNCIATION

Pronunciations have been indicated in the body of this work only for words which present special difficulties. For the pronunciation of other words, consult the Fact-Index. Marked letters are sounded as in the following words: *cāpe*, *āt*, *fār*, *fast*, *whqt*, *fall*; *mē*, *yēt*, *fērn*, *thēre*; *īce*, *bīt*; *rōw*, *wón*, *fór*, *nōt*, *dq*; *cūre*, *būt*, *rude*, *fūll*, *búrn*; *out*; *ū*=French *u*, German *ū*; *ġem*, *ġo*; *thin*, *then*; *ñ*=French nasal (*Jean*); *zh*=French *j* (*z* in *azure*); *κ*=German guttural *ch*.

B

BAAL (*ba al*) Before their voyages the ancient Phoenician sailors burned incense to Baal as the god of fertility who made crops grow and flocks increase. They advertised their national god to the many Mediterranean lands they touched and Baal cults grew up in Asia Minor Egypt Greece Rome and Spain. The greatest general of Carthage was named *Hannibal* (favor of Baal). At one time or another Baal was a deity of the Canaanites the Babylonians the Assyrians and the Arabians. The Bible tells us that even the Jews at times left all the commandments of the Lord their God and served Baal. (II Kings xvii 16)

The word *baal* is Phoenician for owner or lord. Every true field town or mountain which had a religious significance was believed to have its own individual Baal. He was usually represented merely by stones or pillars. Sometimes he

was worshiped as a sun god (called *Melkarth* at Tyre and *Bel-Merodach* at Babylon). As a sun god he had a sinister side and he was held responsible for drought plagues and other natural calamities. His priests would of ten stab themselves believing that the flow of their blood would induce rain. To appease him bulls cocks goats sheep and occasionally human beings were burned alive. The female counterpart of Baal was *Ashtoreth* or *Astarte* worshiped as a goddess of fertility and also as a moon goddess.

BABOON In size and habits the baboons or dog-headed monkeys come between the apes and the tree-dwelling monkeys (see Ape Monkey). About 12 species are known all of them native to Africa or Arabia. Though some of them climb trees most species are found in open rocky places where their only protection is their ferocity their cunning and their habit

of banding together in large groups. Baboons are easy to recognize by their long doglike snouts. Large bare spots on cheeks and buttocks are often brilliantly colored and give them a startling appearance. Their front and hind legs are about the same length which enables them to run fast on all fours. But when fighting they stand erect using their hands to snatch their foes and hold them while they bite and tear with their large canine teeth. Led by old battle-scarred males they can defend themselves successfully against other wild beasts even leopards.

Away from human settlements baboons live chiefly on insects and roots. But whenever they get the chance they feast on farm crops. The long tailed shaggy *chacmas* of South Africa are notorious plantation robbers. Although men and watch dogs are often placed about a field at night a great troop of *chacmas* may slip past with the stealth of seasoned guerrillas. *Chacma* sentinels are then placed

at regular intervals. Only a few of the more experienced baboons enter the field while the others string out in a long queue. Vegetables or corn are then passed along the line until all are satisfied. *Chacmas* often strip a corn field in a single night. When surprised at their raiding, they do not retreat in disorder. While females and young make their way to safety the larger males stand their ground snarling and barking warning their purple

cheeks and gnashing their great teeth. Since they are as large and powerful as mastiffs and as quick as cats men without firearms will not care to approach them.

The largest of the baboons is the monstrous *mandrill*. It has short legs dark brown hair on its body and a stump of tail less than two inches long. The

HE IS AS
SAVAGE AS
HE LOOKS



This is the Aethiops a baboon of Ethiopia. Not so the long dog like snout the snarling expression and the mighty teeth. Beneath his shaggy coat are powerful muscles which make him a formidable fighter.

bare spots on face and buttocks are patterned in vivid blue and scarlet.

The *mantled baboon* or *hamadryad* (*hām'a-drī-ād*) of Arabia and northeastern Africa was worshiped by the ancient Egyptians and was often pictured on their monuments. Its solemn appearance gained it credit for great wisdom. The remarkable shaggy coat of grayish-green is found only on the old males.

Another baboon known to the ancient Egyptians is the *anubis*, with an olive-gray coat, darker paws, and a crest on the nape of its neck. It is found in

the Sudan, Nubia, and on the west coast of Africa. The *yellow baboon* has no crest, is yellowish in color, and is found all across equatorial Africa. Other species are the thick-maned *gelada baboon* of southern Abyssinia, the reddish-brown *Guinea baboon*, and the fierce *drill* which resembles the mandrill, although lacking its size, swollen snout, and gaudy coloration.

Baboons have proved tamable when young. When they grow older, however, they are given to terrible fits of rage and are therefore dangerous.

HOW to GIVE a CHILD the Best Start in LIFE

BABY CARE. Parents have few tasks more exacting than that of properly caring for the newly-arrived infant. Certainly none is more important.

The spirit that prevails in the home affects the baby greatly. He thrives best, physically and mentally, in a harmonious family environment in which mother and father feel secure in their relations with each other. Young couples who anticipate rearing children should know how to establish their home life on a sound basis of mutual affection and confidence.

The first few months of a child's life are especially important because (1) he is then completely helpless and could not survive without proper care; and (2) the *manner* in which this care is given helps to shape all the earlier habits that every infant must acquire. His mode of life during the first year may start him on the road to a stable, healthy, joyous childhood, or it may lead to one that is fretful, unhappy, and uncomfortable for both mother and infant.

Preparing for the First Days

Too often, the very first days during which the mother has responsibility for her newly born infant are days of trial and stress. Such anxious days can be avoided if the new mother will prepare herself for her task. She should acquaint herself, not with a great deal of theory about child care, but with the simplest needs of the child and how to meet those needs. If the baby is born in the hospital, she probably has been instructed while there in the routine of baby care. She should expect that the first day

or two at home may be disturbing to the child. This is the time for the young mother *not* to become alarmed, or anxious at every small sign of discomfort.

When he entered the world, the baby was suddenly exposed to strange surroundings and new experiences, including cold and bright light; therefore, he cried. He continues to be sensitive to these things for many days. So the first thing to do is to put him to bed,

well covered, in a darkened room. In cold weather it may be necessary to use hot-water bottles under the mattress and outside the blankets.

Bathing the Baby

For the baby's first bath the room should be warmed to about 80°F., and the baby stripped and placed on a warm blanket. He is then thoroughly sponged either with water and castile soap or with oil, and then gently dried. The navel should be let alone and covered with a sterile gauze pad about two inches square held in place

by a binder which completely surrounds the abdomen. If the antiseptic which the physician put into the baby's eyes soon after birth discolors the surrounding skin, it may be washed off gently. The eyes and the inner parts of the ears and nose should not be touched. It is advisable to place the baby's bed so that the head is about three or four inches lower than the feet for the first 24 hours. This enables fluids and mucus to run out of the windpipe.

Later on a full bath is given, with care not to allow nose, mouth, or ears to be submerged. After the soap and water, the child is carefully dried, and then oiled or powdered, depending upon whether his

"O GENTLE SLEEP, NATURE'S SOFT NURSE!"



Shakespeare's line above the picture emphasizes a baby's need for many hours of refreshing sleep daily if he is to grow into a healthy child. This little fellow, journeying in Dreamland with his tiny pal, symbolizes all the babies in the world, whose rearing is an endless challenge to their parents.

skin seems to be dry or oily. Any noticeable discharge in the ears, nose, eyes, and mouth should be gently removed, but ruthless reaming with cotton applicators is unpleasant to the baby and is often harmful.

During the first few days the baby's sleep should be disturbed only for his daily sponge bath, changing of diapers, and an attempt at breast feeding about three times a day. It is unnecessary to give any laxative at this time, but he is ready to be given occasional drinks of water from a bottle.

Establishing Proper Eating Habits

At some time during the first few days of his life the baby is disturbed by the feeling of hunger—the gnawing sensation produced by strong movements of the stomach muscles, which usually occur in anyone's stomach when it is empty. The baby naturally responds to this new sensation with a vigorous cry. If he is immediately taken up and put to the mother's breast or given a bottle, he will eagerly make sucking motions and will soon be swallowing. With the first swallow the discomfort in his stomach begins to go away. Thus he learns very early in life that eating is very satisfying. During the next one or two days this procedure should be repeated when the baby shows that he is hungry. After that, his feeding times should be arranged according to schedule, usually with a feeding every three or four hours. If he has learned the pleasure of nursing during the first few days, there is seldom any trouble in getting him to eat enough later.

For the first few months, no food is as good as breast milk from the mother. If the baby is put to the breast regularly, and if he is a vigorous baby, most mothers will have sufficient milk. If, after a thorough trial, it is definitely proved that the baby will not thrive on the amount he gets from his mother, additional food must be given. This is offered to the baby in a bottle, either after he has had what he can get at the breast, or instead of one, two, or three of the breast feedings. The most common additional food which is given nowadays is some modification of cow's milk, diluted evaporated milk, or some of the ready-made infant foods. Generally some form of sugar is added to these mixtures, because mother's milk has much more sugar than has cow's milk. Cod-liver oil and orange juice also are usually added to the diet.

Weaning the baby should not be difficult if he has previously been given a few opportunities to nurse

from a bottle. Gradual substitution of the bottle for the breast usually will forestall his natural reluctance to make the change.

The First Experiments with Solid Food

Food other than milk can be offered at about the fourth month, at this time, most physicians advise cereal once or twice a day. This is as much an educational as a nutritional experience, because it teaches the infant to get used to the spoon. It is advisable to give the new food cautiously, never urging the baby to take more than he wants. As soon as he gets used to the new method he will usually take all that he should. A month or so later he may have sieved vegetables or vegetable soup at the mid-day feeding, thus getting still another taste thrill. He should be given each new article of food two or three days in succession so that those foods which cause trouble may be noted and eliminated.

From six months until he is a year old these foods may be added to the baby's diet: baked potato spaghetti, rice, egg yolk, scraped beef or beef juice, light desserts, toast or zwieback, crackers, cooked or raw fruits, and bacon. Toward the end of this period, it is well to give foods to the baby in a less finely divided form so that he gets a chance to use his teeth, which are now coming in. The cup may also be used at this time, but only if he likes it. By the end of his first year the child is thus taught to eat a large variety of foods from many receptacles.

As a check on the feeding, the child should be weighed every day during the first month or so, and every week thereafter during the first year. For the first four or five months he gains almost an ounce a day. This decreases to only about half a pound a month at the time he is one year old.

Right Habits of Sleep

Habit formation is as important during the baby's first year as proper care. His physical growth and development can be favorably influenced if good habits of sleep are established. During his earliest days the infant tends to sleep most of the time. Gradually his need for prolonged sleep lessens. The very young infant will awaken when he is hungry or uncomfortable, and announce his needs. If he does not, he should be awakened for his regular feedings. By the seventh or eighth month, he will be taking two long naps a day, morning and afternoon, and will have his long, uninterrupted night's sleep of approximately 12 hours.

Every infant should preferably sleep in a room by himself after the first half-year. It is wise to establish

ARTICLES NEEDED FOR THE NEWLY BORN BABY

| Clothing | For the Bath Table | For Preparation of Food | |
|-------------------|-------------------------|----------------------------|------|
| Cotton bands | Absorbent cotton | Nursing bottles | 8 |
| Diapers dozen | Safety pins | Bottles rack | 1 |
| Shorts cotton | Soft hair brush | Nipples | 6-12 |
| Feet sole cotton | Talcum powder | Glass jars for nipples | 3 |
| Nightgowns | Candle soap | Double boiler | 1 |
| Jackets | Boric acid solution | Funnel | 1 |
| Socks pairs | A soft blanket | Fin sieve | 1 |
| Blanket with hood | Towels | Measuring graduate 8-ounce | 1 |
| Mittens pair | Scales bath thermometer | Measuring spoons | 2 |
| Blankets | Olive oil sterilized | Cups and spoons | |

the practise of placing the child in his crih, making sure that he is comfortable, and leaving him at once, with the room darkened and the door closed. If he is restless at first or cries, he should be let alone and he will soon settle down. If he awakens during the night because he is wet or uncomfortable, he should receive the attention he needs; otherwise, he should not be disturbed. A healthy child's restlessness may be merely an attempt to prolong his parent's attention to him.

Training in Cleanliness

The child requires training in proper control of bowels and bladder. Correctly approached, this training offers no great difficulty for child or mother. Conscious control of bowel movement is usually attained in the latter part of the first year. Training earlier than this frequently is unsuccessful and may lead to psychologic disturbances later. The most important feature of training is the establishment of regular habits of elimination. If the mother notes the child's natural tendency, she will see that normally he has bowel movements at fairly regular intervals. Definite habits can be established by encouraging the infant to have a movement preferably directly after feeding, at the time each day at which a movement has usually occurred. As soon as the child is old enough to sit alone, a suitable chair or seat should be provided. Suppositories and laxatives should be used only on the advice of the physician. The mother should overlook the child's accidents and merely persist in her attempts to teach him.

Bladder control also can be established in due time and with little difficulty, if simple routine is persistently followed. During the earlier months after training in bowel control has been initiated, the child will become accustomed to emptying his bladder whenever placed upon the proper receptacle, even though he may wet himself at other times. During the first part of the second year, when the baby begins to walk about the house, it is well to set aside a day or two in which he is placed on the toilet often enough to keep him dry. If this is calmly and placidly carried out, training often can be accomplished speedily. Later when daytime control of the bladder is well established, one may begin to teach control at night. Diapers should be removed at bed-time and the child told that he is now grown up enough to call for his mother or go to the bathroom if he awakens. This procedure should be repeated for two or three nights, with no emphasis on success or failure. If the child still wets the bed after two or three such attempts, the effort should be postponed for several weeks, and then repeated with all confidence of success. Shaming and scolding may do more harm than good.

Learning to Play and Walk

Babies should have simple toys and objects with which to play as soon as they are at all interested or able to use them. An infant five to six months of age will enjoy pounding with a spoon, and an unbreakable cup is a great satisfaction to one just learning to grasp objects. As his ability to use his hands increases,

blocks and nests of hollow cubes are enjoyed. As soon as the toddler is walking, pull-toys add to the zest of getting about. At all times, the toys should be such as will help the child in mastering the particular physical accomplishments of which he is capable. Attention to his immediate interests and to what he is ready to learn next makes his life more enjoyable and aids his learning processes. (See also Play.)

Generally by the age of six months the baby will be making attempts to sit up. During the last quarter or the first year, most infants will support themselves on their feet and walk with help. During the first part of the second year they will usually walk unsupported. When the child is learning to get about, he should have a suitable play pen, or some arrangement which gives him opportunity to support himself in moving about and at the same time protects him against injury.

Put the Child's Needs First

The child's needs, not the parents' desires, must invariably come first during the early years. It is natural for parents to desire to shower the baby with affection and attention—to display him and otherwise show their great satisfaction in his growth and development. This must not be done, however, at the expense of the routine so necessary to the development of good health and good habits. There is plenty of opportunity to enjoy one's child without sacrificing this routine.

Wise parents let their child take each new step in his development at his own pace. They do not attempt to hurry his progress beyond his physical and mental capabilities simply because other children of his age may be more advanced. On the other hand, they must not retard his progress.

Many children are anxious and somewhat fearful in meeting new situations and new demands, and so parents must give due heed to the child's weaknesses and failings. In general, children tend to venture courageously and attempt to do all manner of things for themselves. Others, however, tend to stick to the certainties of old and familiar situations and to resist change and forward movements. This latter tendency becomes emphasized in those children who are not encouraged to do things for themselves. (See also Child Development.)

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BABYLON On the Fuphrates River in the land that is now Iraq ruins of the world's first great city stand alone in the desert. The city bore the proud name Bab-Ilu meaning gate of the gods. The Hebrews called it Babel. In the Greek and Latin languages the name took the form Babylon and the plain on which the city stood was called Babylonia.

During the first thousand years of its known history Babylon was a mere village. It became the capital of the kingdom of Babylon about 1850 B.C. and reached its first peak of glory in the reign of Hammurabi the lawgiver. This great king beautified the city with palaces, temples and towers and made it the religious and cultural center of western Asia. In its temples scholarly priests copied and preserved the writings of the Sumerians from whom the Babylonians derived their civilization. Centuries later when the warrior kingdom of Assyria subdued Babylonia the Assyrian kings still looked to Babylon as the center of their own culture.

When Assyria declined Babylon rose once more to wealth and imperial power under Nebuchadnezzar II (604-561 B.C.). This king is remembered in the Old Testament for his destruction of Jerusalem and the Babylonian captivity of the Jewish people (see Jews). In Babylonia he was celebrated as the builder who made Babylon the most splendid city in the world.

The original city stood on the right (west) bank of the Euphrates. Nebuchadnezzar extended it to the left bank as well and built a stone bridge across the river. The city was in the shape of a square surrounded by a massive towered wall. Twenty-five

principal streets crossed the city each way at right angles. In the wall at the end of each street was a huge gate of brass. Smaller brass gates opened on steps that led down to the river. Palaces and temples were of vast dimensions built of brick and faced with glazed brick in many colors. Houses were two to four stories high but around an open courtyard.

Nebuchadnezzar's own great palace achieved a touch of fairyland from its famous Hanging Gardens which the Greeks counted as one of the Seven Wonders of the World (see Seven Wonders of the World). The beautiful Gate of Ishtar spanned Procession Street which led to the Temple of Marduk chief god of Babylon. Near it stood a great terraced tower (ziggurat) built in seven receding stories with a sloping ramp spiraling around it to the top. This may have been the original Tower of Babel described in the Bible (Gen. xi) but it was only one of many artificial holy mountains in and around Babylon.

Babylon lost its independence forever when it fell to Cyrus the Great of Persia in 539 B.C. but it continued to be a center of trade and culture. It was still fairly prosperous when Alexander the Great took up his residence in Nebuchadnezzar's palace where he died in 323 B.C. His successor Seleucus built a new city Seleucia nearby on the Tigris because it had a deeper channel for navigation. From that time Babylon rapidly decayed. Its structures were torn down to provide brick for building elsewhere and the once proud capital was reduced to a vast ruin. (See also Babylonia and Assyria Mesopotamia.)

Where WESTERN CIVILIZATION BEGAN

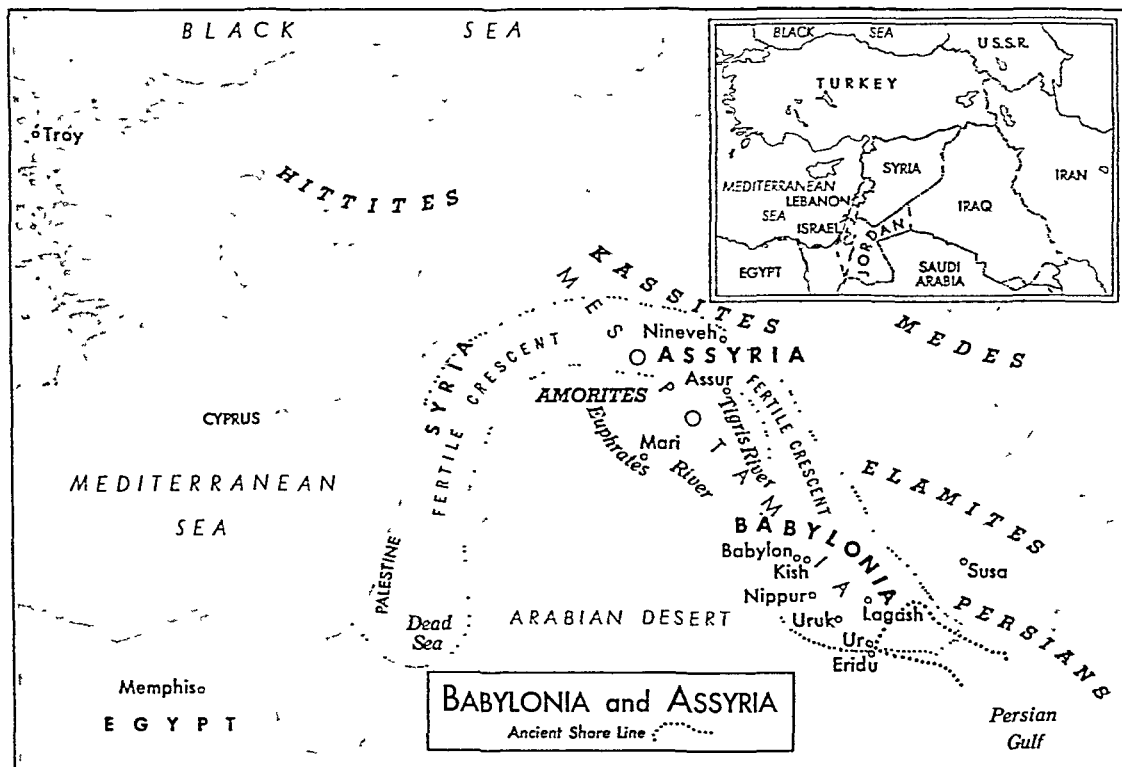
BABYLONIA AND ASSYRIA The story of our own Western civilization begins on a small plain in southwest Asia. Here 50 centuries ago cities rose, government developed and great inventions—including writing—were made. The civilization on that was born here spread westward to Palestine, Greece and Rome. From these Mediterranean lands it entered the main stream of Western civilization.

The Babylonian plain is very fertile. The land was built up of mud and clay deposited by two great rivers, the Tigris and the Euphrates. These two rivers come down from mountains in the north cut southeastward through hilly grasslands and finally cross the plain they created to reach the Persian Gulf. The Greeks named the land between them Mesopotamia, land between the rivers. Today it is called Iraq. Tradition says the Garden of Eden was here.

Three main peoples contributed to the civilization of Mesopotamia. The earliest were the Sumerians. They lived in a small area, no bigger than a county around



This is Gudea, who ruled the city-state Lagash in Sumer more than 4,000 years ago. Sumerian men shaved their heads and faces and wore thick woolen skirts. The statue is in the Louvre.



The earliest cities of which we have records appeared around the mouths of the Tigris and Euphrates rivers. Gradually

the mouths of the Two Rivers. Their land was called Sumer (in the Bible, Shinar). The culture they originated spread to the Semitic peoples, who lived side by side with them. About 1800 B.C. political power moved north up the Euphrates to the Semitic city of Babylon in Akkad. The entire plain then became known as Babylonia. Centuries later the center of power moved north once more to warlike Assyria, in the rolling hill country of the upper Tigris Valley.

Just as in ancient Egypt civilization first appeared on the lower Nile, so in Mesopotamia the earliest cities clustered around the mouth of the Euphrates. It

civilization spread northward and around the Fertile Crescent. The small map shows the nations that occupy this area today.

is now generally admitted that Babylonian civilization was somewhat earlier than that of Egypt.

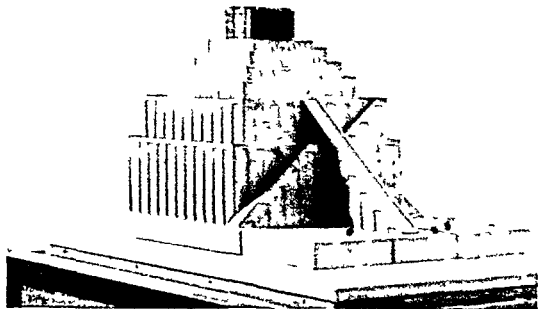
The Sumerians Build the World's First Cities

We do not know who the Sumerians were or when they first appeared in Mesopotamia. Their language has no relation anywhere. We do know they were a highly gifted and creative people.

Mesopotamia is a land of blazing sun and very little rainfall. Farming can be carried on only by irrigation. Centuries before the beginning of history, the Sumerians undertook the stupendous task of building embankments to control the flood waters of the Euphrates River. Gradually they drained the marshes and dug irrigation canals and ditches. Large-scale co-operation was needed to build the irrigation works, keep them in repair, and apportion the water. This need gave rise to government and laws.

The rich soil produced abundant crops of barley, emmer, beans, olives, grapes, and flax. For the first time there was a surplus to feed city workers—artists, craftsmen, and merchants. With this great change in living habits, civilization began. The name "urban revolution" has been given to this new period in history. There were still no nations, only small city-states. The ruler of a city-state was called an *ensl*.

The Sumerians built their villages on artificial mounds to protect them from any normal floods. Very early they learned to make bricks in molds and dry



MODEL OF A ZIGGURAT

Each city built a lofty artificial mountain, at the top of which stood a temple to the people's chief god. This is a reconstruction of the Tower of Babel, described in the Bible.

them in the sun or burn them in kilns. The houses were small and crowded close together on narrow lanes. Some were two or more stories high. The whole city was surrounded by a wall for protection. Outside the wall were the huts of the poor built of reeds plastered with clay.

Each city grew up around the shrine of a local god. As a city grew in wealth its temple became an elaborate structure. The temple buildings stood on a spacious raised platform reached by staircases and ramps. From the platform rose the temple tower called a ziggurat (holy mountain) with a circular staircase or ramp around the outside. On the temple grounds were quarters for priests, officials, accountants, musicians and singers, treasure chambers, storehouses for grain, tools and weapons, workshops for bakers, pottery makers, brewers, leatherworkers, women spinners and weavers and jewelers. There were also pens for keeping the sheep and goats that were destined for sacrifice to the temple god.

Horses and camels were still unknown, but sheep, goats, oxen, donkeys and dogs had been domesticated. The plow had been invented and the wheel (a solid piece of wood) was used for carts as well as for shaping



A PHYSICIAN'S SIGNATURE

This delicate relief was made by rolling a small cylindrical seal over wet clay. A Sumerian physician who lived in Larsa about 2000 B.C. used the seal to put his signature to documents.

pottery. Oxen pulled the carts and plows; donkeys served as pack animals. Bulky goods were moved in boats on the many rivers and canals. The boats were usually hauled from the banks, but sails also were in use. Before 3000 B.C. the Sumerians had learned to make tools and weapons by smelting copper with tin to make bronze, a much harder metal than copper.

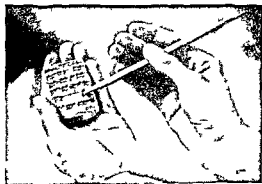
Mud, clay and reeds were the only materials the Sumerians had in abundance. Trade was therefore necessary to supply the city workers with materials. Merchants went out in overland caravans or in ships to exchange the products of Sumerian industry for wood, stone and metals. There are indications that Sumerian sailing vessels even reached the valley of the Indus River in India. The chief route, however, was around the Fertile Crescent, which lies between the Arabian Desert and the northern mountains. This route led up the valley of the Two Rivers, westward to Syria, and down the Mediterranean coast.

They Learn to Write on Clay

Whether the Sumerians were the first to develop writing we cannot say. At any rate, their writing is the oldest that has come down to us. They wrote on clay. Clay tablets, when baked, are almost indestructible. Archaeologists have dug up many thousands of them. Some may be older than 3000 B.C.

The earliest writing of the Sumerians, as of other people, was picture writing. They began to develop their special style when they found that on soft wet clay it was easier to impress a line than to scratch it. To draw the pictures they used a stylus—probably a straight piece of reed with a three-cornered end. An unexpected result came about. The stylus could best produce triangular forms (wedges) and straight lines. Curved lines therefore had to be broken up into a series of straight strokes. Pictures lost their form and became stylized symbols. We call this kind of writing on clay *cuneiform* from the Latin *cuneus* meaning wedge.

A tremendous step forward was taken when the symbols came to be associated with the *sound* of the thing shown rather than with the *idea* of the thing itself. Each sign then represented a syllable. Cune form writing never developed an alphabet, although it continued to be written long after the alphabet appeared.



PUPILS LEARNED TO WRITE IN THIS CLASSROOM. Long ago students sat on these hard benches in a schoolroom in Mari and practiced the difficult art of cuneiform writing. In the top picture, a modern scholar shows how the stylus was used to impress wedges and lines on a clay tablet.

Schools for Reading, Writing, and Arithmetic

Cuneiform was difficult to learn. The boy or girl who wanted to master it usually went to a temple school. The textbooks were clay tablets. The teacher wrote on the left-hand side and the pupil copied the model on the right. If he made a mistake, he could smooth it out. He began by making single wedges in three positions, horizontal \neg , vertical Υ , and oblique \wedge . Then he went to work on wedge groups, such as ∇ (pronounced *lim*). Thousands of groups had to be mastered. Finally he was set to copying a book. Usually he did not get very far. Many first chapters of all important works have come down to us from students' tablets. Of the rest of the books there are only fragments.

The pupils also studied arithmetic. The Sumerians based their number system on 10, as we do, but they multiplied 10 by 6 to get the next unit; multiplied 60 by 10; and then multiplied 600 by 6, and so on. The number 60 has the advantage of being divisible by 2, 3, 4, 5, 6, 10, 12, 15, and 20. We follow the Sumerians in dividing the circle into 360 degrees. From these early people we also get our "dozen" (a fifth of 60) and our division of the clock to measure hours, minutes, and seconds.

The Sumerians had standard measures, with units of length, area, and capacity. The standard weight, the mina, made up of 60 shekels, was about the same as our pound. Sixty minas made one talent. There

was no coined money. Standard weights of silver served as measures of value and as a means of exchange.

From the earliest times the Sumerians had a strong sense of private property. Having learned to write and figure, they kept documents about every acquired object, including such small things as clothes and shoes. Every business transaction had to be recorded. Near the gate of a city a scribe would sit ready to sell his services. His hands would move fast over a lump of clay, turning the stylus. Then the contracting parties added their signatures by means of seals. The usual seal was an engraved cylinder of stone or metal that could be rolled over wet clay.

In the course of time cuneiform was used for every purpose, just as writing is today—for letters, epics and legends, prayers and incantations, dictionaries, even mathematical and astronomical treatises. The Babylonians and Assyrians adapted cuneiform for their own Semitic languages and spread its use westward into Syria, Anatolia, Armenia, and Iran.

Stories of Gods and Heroes

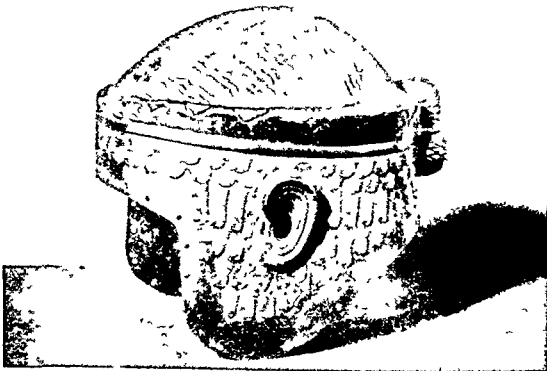
As people got acquainted with the gods of other cities, they worked out relationships between them, similar to the relationships of people on the earth. Anu, a sky god, originally the city god of Uruk, came to be regarded as the greatest of all the gods. His closest rival was the storm god Enlil of Nippur. The great gods were worshiped in the temples. Each family had little clay figures of its own household gods and small houses or wall niches for them.

The Sumerians knew that their ancestors had created the ground they lived on by separating it from the water. According to their Creation myth, the world was once watery chaos. The mother of Chaos was Tiamat, an immense dragon. Gradually the gods appeared and decided to bring order out of Chaos. Tiamat created an army of dragons. Enlil called the winds to his aid. Tiamat came forward, her mouth wide open. Enlil pushed the winds inside her and she swelled up so that she could not move. Then Enlil



FOUND IN THE ROYAL CEMETERY AT UR

About 2700 B.C. an artist decorated the sounding box of a lyre with these comic pictures (left), which probably illustrate a well-known fable. The pictures are mosaics of shell, gold, and silver on a background of lapis lazuli. The lyre, 49 inches



high, is in the University Museum, Philadelphia. A king probably wore this beautiful helmet of pure gold (right). It is in the form of a wig, with hairs chased, and locks and curls hammered out in relief. The helmet is in the Baghdad Museum.

split her body open. He laid half of it flat to form the earth. The other half he arched over the earth to form the sky. The gods then beheaded Tiamat, a husband and created man from his blood mixed with clay.

The longest story is the Gilgamesh epic. Gilgamesh, a great hero like Hercules, started out from Uruk to search for the plant of life. After many adventures he found the plant and put it in his boat, but a serpent came up out of the water and snatched it away.

Another search for eternal life was Adapa, a fisherman. He had gained wisdom from Ea, god of water. The other gods, jealous of his knowledge, called him to heaven. Ea warned him not to drink or eat while there. Anu offered him the water of life and the bread of life because he thought that since Adapa already knew too much he might as well be a god. Adapa, however, refused and went back to earth to die, thus losing for himself and for mankind the gift of immortality. These stories resemble somewhat the Bible story of Adam and Eve (Genesis 22).

Floods were an ever-present danger to the Sumerians. One story tells of a great flood that covered all the land. Utnapishtim, like Noah in the Bible, built a large ship in which he saved his family and the beasts of the field and the birds of heaven.

The Sumerians Disappear as a People

The cities of Sumer warred with one another from time to time, and strong rulers spread their power

over neighboring cities. Each of the important cities enjoyed its day of glory—Lagash, Uruk (Uruk in the Bible) and Ur. Kings (called lugal) replaced the city rulers (ensi). In general, however, the Sumerians seem not to have been a very warlike people. They had only a citizen army called to arms in time of danger.

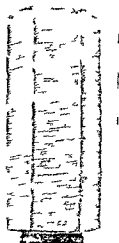
About 2340 B.C. a Semitic king, Sargon of Akkad, conquered the Sumerians and then went on to build an empire that stretched westward to the Mediterranean Sea. The empire was short-lived, but while it lasted, art and literature flourished.

Led by Ur (the city from which Abraham is said to have set out on his travels), the Sumerians again spread the rule far westward. During Ur's supremacy (about 2150–2050 B.C.) Sumerian culture reached its highest development. Shortly thereafter the Sumerians lost their independence forever and gradually they completely disappeared as a people. Their language, however, lived on as the language of culture just as Latin did in the Middle Ages, and their writing, their business organization, their scientific knowledge, and their mythology and law were spread westward by the Babylonians and Assyrians.

The First Kingdom of Babylon

The city of Babylon now rose to power (see Babylon). Its brilliant First Dynasty lasted 300 years and reached its greatest glory about 1800 B.C. under the great king Hammurabi. Hammurabi spread the rule of Babylon south into Sumer and westward around the Fertile Crescent into Syria, on the Mediterranean. He was most famous, however, for the code he published to unify the legal practices in his empire. He had the law code inscribed on a huge pillar or stele set up in a public place and sent copies of it to all his governors and judges. At the top of the stele, Hammurabi was pictured as receiving the laws from a god, although most of the laws were already old and had long been in writing.

The code supplies a wonderful insight into the habits and customs of the time. Women were free and respected. There was a system of police and a postal service. Trade with distant lands flourished. The people were divided into three classes—nobles with hereditary estates, freemen who could own land but not leave it to their children, and slaves who were sold in the open market. Enslavement for debt



A PRISM BOOK

This six-sided clay book contains an account of the Assyrian king Sennacherib's siege of Jerusalem.



SARGON II WITH ASSYRIA'S GOD

Sargon, accompanied by an attendant, stands facing a god, probably Assur. The god holds a staff and a ring and seems to be investing the king with these symbols of royalty. The picture is a restoration of a painted plaster decoration found in the ruins of Sargon's palace at Dur Sharrukin (now Khorsabad, Iraq).

was legal, but most of the slaves were captives taken in war. Maximum prices and maximum (not minimum) wages were fixed by decree. Punishments were very severe, usually based on the principle of "an eye for an eye and a tooth for a tooth." For example, if a man destroyed another man's eye, his own eye was put out.

Babylonian Gods—Marduk, Ishtar, and Tammuz

Hammurabi made his own Semitic language official throughout his kingdom and raised the god of Babylon, Marduk, to first place among the deities. Scholars rewrote old Sumerian myths and gave Marduk credit for creating the universe instead of Enlil. The Babylonians' chief female deity was the ancient mother goddess Innini of Uruk, renamed Ishtar.

Ishtar, as goddess of fertility, could grant her worshipers crops, lambs, or children. Her son Tammuz was associated with vegetation. In the hot midsummer month—called Tammuz—vegetation dried up, and people fasted until Tammuz rose from the dead and made the earth green again. The worship of Ishtar (also called Astarte) and Tammuz spread over southwest Asia and reached Egypt in the myth of Isis and Osiris. Later the deities appeared in Greece as Demeter and Persephone. In Palestine, as late as 600 B.C., the prophet Ezekiel was horrified to see women in Jerusalem "weeping for Tammuz" (Ezek. viii, 14).

The Kingdom of Assyria

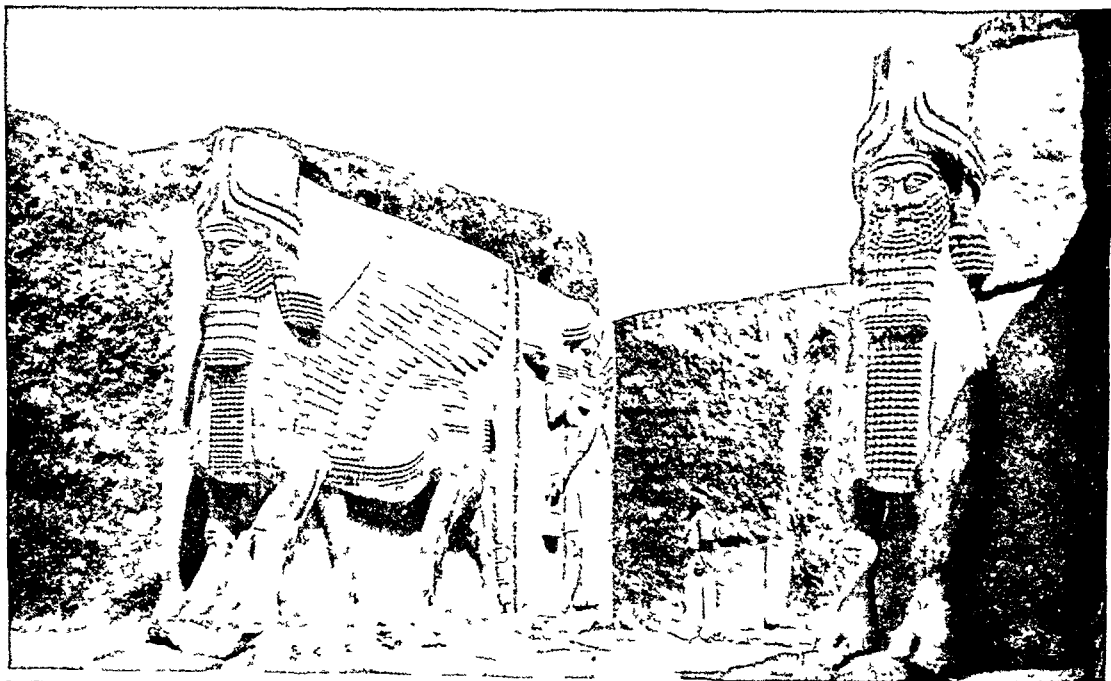
After Hammurabi's death, wave after wave of barbaric Indo-European tribes swept down from the

northern mountains. For centuries the entire civilized world was plunged into darkness. The Hyksos invaded Egypt. The Kassites overran Babylonia. The Hurrians occupied the rest of the Fertile Crescent, from Assyria into Palestine. This period has been called the Middle Ages of antiquity. About 1400 B.C. the Assyrians freed themselves from the invaders' rule. Then they extended their kingdom northward.

Assyria took its name from its chief city, Assur, on the upper Tigris. Lying north of Babylonia, on the great trade route of the Fertile Crescent, the country was frequently invaded from the north as well as from the south. Constant warfare made the Assyrians fierce fighters, and traders who passed their way were forced to pay them tribute for protection.

The Assyrians had long been under the control of Babylon and had absorbed Babylonian culture. Like the Babylonians they were Semites, and their language was almost identical with the Babylonian. From the Hittites they learned the use of iron and developed powerful weapons. From them they also acquired horses and were the first to use them in war as cavalry instead of for drawing chariots. They built up a military state, organized for war; and they boasted of their cruelties in order to strike terror into the hearts of their enemies.

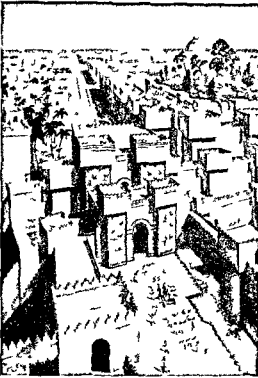
Assyria's greatest period of expansion took place as the power of the Hittites and Egyptians gradually weakened in Syria and Palestine. The Assyrian king Tiglath-Pileser III (745-727 B.C.) took Damascus, in Syria. Sargon II (722-705 B.C.), most famous of



HUMAN-HEADED WINGED BULLS FRAME A PALACE GATEWAY

These Assyrian bulls, carved in alabaster, stand 16 feet high and weigh 40 tons. Behind each bull stands a winged human

figure carrying a bucket and cone. The gateway was the outer portal of the fortresslike palace of Sargon II at Dur Sharrukin.



BABYLON IN NEBUCHADNEZZAR'S TIME

This painting shows how Babylon probably looked in the 6th century B.C. A procession is passing through Ishtar Gate to the temple quarter of the city. High above the buildings float the famed Hanging Gardens. Beyond the gardens rises a ziggurat.

Assyrian kings made Israel an Assyrian province and carried into the interior of his empire 30,000 Israelites (the so-called Ten Lost Tribes of Israel). His son Sennacherib (705-681 B.C.) took Tyre and Sidon in Phoenicia. Esarhaddon (681-669 B.C.) conquered Egypt. Assurbanipal (669-626 B.C.) the last of the great Assyrian kings subdued Elam east of Mesopotamia and stretched the empire to its greatest extent. Roads were built to enable the Assyrian armies to reach rebels quickly. A highly organized mail service carried messages from the court to faraway governors. All conquered territories paid tribute to the king.

Sargon II built north of Nineveh a palace far surpassing anything seen before his day. It covered 25 acres and had nearly 1,000 rooms. Near it stood a seven-story ziggurat temple. Sennacherib put up three magnificent palaces in his capital at Nineveh. The Babylonians had covered their brick walls with glazed brickwork of many colors (see Architecture). The Assyrians faced their walls with delicately carved slabs of limestone or glowing alabaster. The scenes depict only military exploits and hunting. The men all look alike and are all expressionless, but the king is distinguished by his curled hair and beard. The animals in the hunting scenes

are extraordinarily lifelike, depicted in motion in all their pain and terror. Colossal human-headed winged bulls or lions carved in alabaster stood guard outside the main gates of palaces and temples. The Assyrians produced little literature, but they preserved in great libraries copies of Babylonian and Sumerian works. They worshiped the old Babylonian gods but gave their own god Assur first place.

When Assurbanipal, the last great king, died, Assyria's enemies combined. In 612 B.C. the Babylonians and Medes attacked Nineveh and the Assyrian empire collapsed. Six years later in 606 B.C. Nineveh was destroyed. (See also Nineveh.)

The Chaldean Empire

After the fall of Assyria, Babylonia enjoyed 70 years of independence. The Chaldeans, a little known Semitic people, became the ruling class of the New Babylonian or Chaldean Empire. Most famous of the Chaldean kings was Nebuchadnezzar II, who rebuilt Babylon (see Babylon). Science—particularly astronomy and mathematics—made great progress and strongly influenced the Greeks. From towering ziggurats, astrologer-priests read the stars. To interpret the will of the gods, they mapped the sky into the 12 signs of the zodiac and studied the paths of the planets Jupiter, Mars, Venus, Mercury, and Saturn. They could even predict eclipses.

Nebuchadnezzar II carried his conquests to the border of Egypt, but the days of his empire were numbered, as Daniel told Belshazzar in the interpretation of his dream (Dan. v. 26). Cyrus king of Persia advanced into Babylonia, and one city after another surrendered to him. Babylon itself was taken without fighting in 539 B.C. and became part of the mighty Persian Empire (see Persian History).

The Persian Empire lasted more than two centuries until the conquests of Alexander the Great. Then Mesopotamia was ruled in turn by the Greeks, Romans, Arabs, and Turks (see Mesopotamia). It is now the independent kingdom of Iraq (see Iraq). (For Reference—Outline and Bibliography, see Ancient History.)

BACCHUS The Romans gave the name Bacchus to the Greek god Dionysus. He was worshiped at first as the god of all vegetation, but later as the patron of vineyards and of wine (see Dionysus).

BACH (bâk) **Johann Sebastian** (1685-1750) By the light of a midnight moon a young boy sat copying music from a large manuscript book. He strained his eyes to see the notes and stopped at times to rub his cramped fingers. Finally the moonlight dimmed and with a sigh he quietly returned the book to its shelf. Then he hid the copy he had made and crept noiselessly to bed.

Thus 12-year-old boy was Johann Sebastian Bach, an orphan. His brother his guardian and music master had refused him the use of the book, telling him that its music was too difficult for one so young. But with a love of music that would not be denied

the boy spent night after night secretly copying the scores. It was this work perhaps that injured his eyes and brought on blindness during his last years.

The whole life of this German musician was filled with incidents that show his devotion to his art. When he was a choir boy he spent all his recreation hours at the organ or clavier. When he was able to fill the position of organist, he saved and scrimped and traveled many miles on foot to hear the greatest organists of the day and to study under them. In later years, although his duties as choirmaster in Leipzig made demands that might have kept two musicians busy, Bach found time to compose choral, organ, and piano pieces that were to become "the most universal force in the development of music." Even when totally blind, he dictated the choral 'Herewith I Come Before Thy Throne'. The 'Well-Tempered Clavichord' was written for the instruction of his sons, and some of his finest cantatas were composed for his wife and daughter to sing.

The Bach family had furnished noted musicians to Germany for six generations. Johann Sebastian Bach was soon recognized both as the greatest of all this musical line and as one of the greatest organists and clavier players of the day.

In his time he was not generally known as a composer, and almost a hundred years passed before his music was widely published and appreciated. Now critics find no phrase too extravagant to describe the place his compositions fill in the literature of music. Bach has been described as "the man who suddenly surpassed all that had been done before him, while at the same time anticipating all that was to be written in the future." The greatest of modern musicians have acknowledged their indebtedness to him.

Bach perfected the tuning of the clavichord, as the early piano was called, so that a new scale could start on any note (see Music). Bach was the first to teach musicians to use all five fingers in playing keyed instruments. His chorals—notably the St. Matthew Passion, the St. John Passion, the Mass in B Minor—have never been surpassed, and his orchestral music is remarkable for its originality and the richness of its harmonies. Bach died at Leipzig. The house in Eisenach in which he was born is now a Bach Museum.

BACON, Lord Francis (1561-1626). Next to Shakespeare, the greatest intellectual figure in the wonderful Elizabethan Age of England was Sir Francis Bacon, who was made a peer under the titles Lord Verulam and Viscount St. Albans. Though a great philosopher, statesman, and jurist, Bacon was not always a great man. He showed at times some of the

baser characteristics of human nature, including ingratitude (so it was charged) to his patron, the Earl of Essex; so that the poet Pope unjustly styled him "the wisest, brightest, meanest of mankind."

By birth Bacon had many advantages. His father was Lord Keeper of the great seal of England, and his boyhood was spent at the court of Elizabeth I. At 12 he entered Trinity College, Cambridge, but remained there only three years because he thought "the whole plan of education was radically wrong." He was next sent to France with the English ambassador so that he might learn "the arts of state."

His father's death for a time ended all hope of advancement at court. Cut off from the honors which he had hoped to gain, Bacon then turned his attention to law. He was admitted to the bar in 1582, and his success was immediate, for he was a convincing speaker and a sound lawyer. The poet Ben Jonson declared that "the fear of every man that heard him was lest he should make an end." Through the friendship of the Earl of Essex, Bacon won advancement at the court. In spite of writing that "There is no vice that doth so cover a man with shame as to be found false and perfidious," he later repaid the earl's kindness by helping to convict him of treason and to bring him to the block.

Bacon rose rapidly to the positions of attorney general, privy councillor, and lord chancellor, in the latter position being head of the Court of Chancery as well as presiding officer of the House of Lords. Students now recognize

that he was one of the profoundest statesmen of that age, but the good advice which he gave King James I was usually disregarded.

In his published essays Lord Bacon gives this advice: "Seek not proud riches, but such as thou mayest get justly, use soberly, distribute cheerfully, and leave contentedly." But he himself was charged with receiving bribes in his court, and was impeached and convicted; he was sentenced to imprisonment and to pay an enormous fine, and was prohibited from afterwards holding a public office. Although Bacon proudly boasted that he had been "the justest chancellor that hath been" since his father's day, he confessed that his punishment "was just and for reformation's sake," because the old practises which he had carelessly followed were bad.

He was soon released from prison (after four days) and excused from paying the fine, but his exclusion from office continued in force. Cut off from his cherished career, he turned all of his attention to literary and scientific pursuits. He urged that in science men should reach their conclusions only by



JOHANN SEBASTIAN BACH

Bach's genius has been increasingly recognized by music lovers and by composers.

experimentation, and so he is considered one of the founders of the modern "inductive," or scientific, method of inquiry. His essays are full of shrewd observations, such as "He that hath wife and children hath given hostages to fortune", "Reading maketh a full man, conference a ready man, and writing an exact man", "States as great engines move slowly". Bacon's life was sacrificed to his search for truth. While studying to see if snow would preserve meat he caught a cold which proved fatal.

In the 16th century several writers attempted to show, on the strength of alleged "cipher" messages in Shakespeare's works, that Bacon wrote those immortal plays. The great majority of scholars, however, treat these claims as fantastic.

Bacon's principal writings are 'Essays' (1597) 'The Advancement of Learning' (1605), 'Novum Organum' (1620), 'History of the Reign of Henry VII' (1622), and the 'New Atlantis' (1626).

BACON, Nathaniel (1648-1676) Thoughtful student of American history see in "Bacon's Rebellion" of 1676 the spirit of the Revolution of a century later.

The Virginia colony at that time was badly misgoverned by Sir William Berkeley, the tyrannical governor appointed by the English king. The colonists burned with discontent and the Indians boldly attacked outlying plantations. When no official measures were taken to stop the Indian outrages Nathaniel Bacon, a young lawyer who had emigrated from London to become a planter, organized his neighbors and punished the guilty tribes. The obstinate and wilful conduct of Governor Berkeley caused the movement to broaden into a struggle of the democratic element among the colonists against the old aristocratic clique who supported the governor. In the course of the struggle Bacon burned Jamestown to the ground and drove the tyrannical governor to take refuge on an English ship.

Soon after this, Bacon died suddenly and the rebellion collapsed. Governor Berkeley executed terrible vengeance on his foes, hanging more than 20 of them. King Charles II was emphatic in his disapproval of Berkeley. The affair created a great stir in London and secured more respectful attention to the needs and wishes of the colonists.



SIR FRANCIS BACON

BACON, Roger (1214?-1294?) Three hundred and fifty years before Francis Bacon revolutionized scientific method, the English friar Roger Bacon began stressing the need for observation and experiment as the true basis of science (See also Bacon, Lord Francis, Science).

After studying at the universities of Oxford and Paris, Roger Bacon became a Franciscan friar and taught at Oxford. He was far in advance of the scholars of his day. He believed that knowledge could be more certain and rapidly advanced by experimenting with real things than by poring over the books of Aristotle. He knew something of gunpowder and the magnetic needle and gave directions for constructing a telescope. He believed that the earth was round and that it was possible to reach Asia by sailing westward. In one of his numerous writings he suggested the possibility of these modern inventions.

"Ships will go without rowers and with only a single man to guide them. Carriages without horses will travel with incredible speed. Machines for flying can be made in which a man sits, and skillfully devised wings strike the air in the manner of a bird. Machines will raise infinitely great weights, and ingenious bridges will span rivers without supports."

Is it surprising that to the Middle Ages Bacon's knowledge seemed the result of magic? Again and again he was ordered by his superiors to cease writing and teaching. But in Pope Clement IV for a time he found a friend who commanded him to set forth his views in a book.

In spite of the jealousy of his brother friars and superiors and the want of funds, instruments, writing materials, and copyists, Bacon in 18 months produced three great books ('Opus Majus', 'Opus Minus', and 'Opus Tertium'), which he sent to the pope. After Clement's death, Bacon again fell into difficulties as a result of his attacks on the scholars and learning of his day. By order of the head of the Franciscans he was sent to Paris and confined in a monastery for several years. While there he wrote his 'Compendium of Theology', which appeared in 1292.

Because he was so far in advance of his time it is only in our own day that Roger Bacon's true greatness as one of the world's most original thinkers has been recognized.



MONK WHO FORESAW AIRPLANES

Here in his monk's cell, surrounded by his books, tools, and simple scientific equipment, Roger Bacon tries out his theories. Curious eyes watch him as he works.

BACTERIA—

Tiny Plants That Are All Around Us

BACTERIA. All about us are members of the plant kingdom that we do not see. Many of us are unaware of them. These plants are called bacteria. The reason we do not see them is that they are microorganisms (microbes)—too small to be seen without the aid of a microscope. It would take about a million bacteria to cover the head of a pin.

One often hears of the harmful things bacteria do. It is true that a few do cause sickness. (These are popularly called "germs.") Others are responsible for the spoilage of food. Most bacteria, however, are helpful to mankind. Indeed, without them there would be no plant or animal life on the earth.

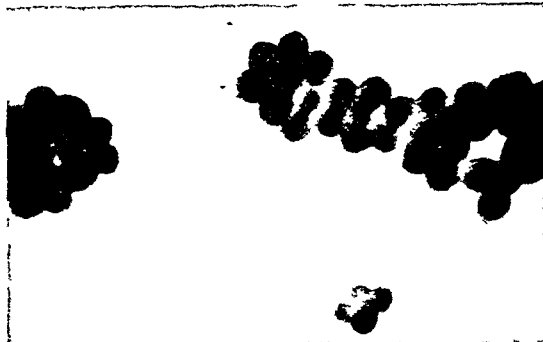
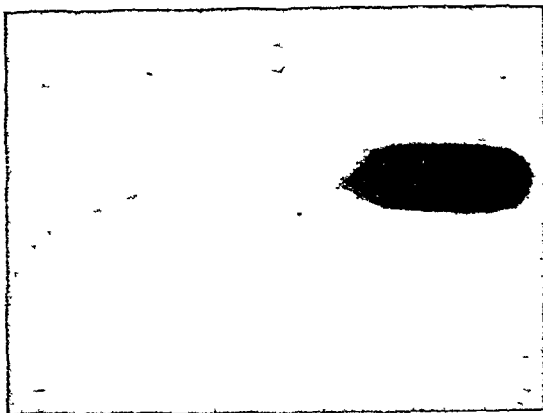
The study of bacteria and related forms of life is called bacteriology, or microbiology. This science is still relatively new. It offers many opportunities for the exploring mind.

What Bacteria Are and Where They Are Found

Bacteria belong to the large group of simple plants known as *fungi*. Each bacterium consists of a single cell, with a nucleus and an outer wall. Fungi do not contain the green pigment chlorophyll that is characteristic of flowering plants (see *Fungi*). Bacteria often possess other color tints; but the jellylike cells are almost transparent, so that it is necessary to stain them with a dye to see them clearly.

Like the amoeba and other single-celled organisms, bacteria reproduce by dividing in the middle to form two (see *Amoeba*). After these two reach maturity, they in turn divide to form four. The technical term *Schizomycetes* (fission fungi), by which bacteria are classified, comes from their method of reproduction. The division may occur as rapidly as every 20 minutes. This means billions of bacteria may be formed from a single bacterium in 24 hours.

Bacteria are found in more places than any other living thing. A pound of fertile garden soil may contain as many as 50 million. They are present on human skin and on animals, insects, and plants. They thrive in the intestinal tract of man and other animals. They exist in the ocean, on the desert, in hot springs, and in the snow of polar regions. Bacteria have been found many miles high in the air as well as at the bottom of rivers and lakes and in the deepest mines. About the only two places where they cannot be found are in healthy animal tissue and in places that are very hot, such as the coals of a fire or the pit of an active volcano. Some, however, are able to grow at



BACTERIA HAVE SIMPLE SHAPES

Bacilli (top) are shaped like straight rods. Cocci (center) are sphere-shaped. Spirilla (bottom) may be spiral-shaped, like corkscrews, or merely slightly curved.

temperatures high enough to kill animal life. These are called *thermophilic* (heat-loving) bacteria.

Bacteria are smaller than their cousins, the yeasts, but somewhat larger than the viruses, which are the smallest form of living matter (see *Virus*). A new unit of length, the micron, was devised to measure them. It takes 1,000 microns to make one millimeter and about 25,000 to make one inch. Some bacteria are so small that their largest dimension is only one half a micron. Others may be as large as two microns in diameter and 200 microns long, although bacteria of this size are rare. (See *Micrometer*.)

The electron microscope, which can magnify as much

as 100 000 times, has greatly increased man's knowledge of bacteria. The compound microscope, the only one available for many years, was limited to a magnification of about 1,000 (See Microscope)

How They Live

Bacteria absorb their food and secrete their wastes through the cell wall. They secrete enzymes that break down the food into soluble form so that it can pass through the wall. Inside the cell other enzymes bring about further changes (See Enzymes). Some bacteria can live on simple mineral compounds. Others have very complex food requirements.

The so-called *autotrophic* (self nourishing) bacteria can manufacture all the carbohydrates, proteins, fats and vitamins they need from simple inorganic substances such as sulfur, the minerals in water and carbon dioxide from the air. At the other extreme are the disease bacteria, which are parasitic. They rely on their host to supply their food in a predigested form. The *saprophytes* live on decaying remains of plants or animals. The *anaerobes* can grow without air because they obtain their oxygen from their food. Many kinds can grow either with or without air.

Many bacteria are able to move through liquids, some very rapidly, by means of hairlike appendages called *flagella*. Others are carried about on animals or insects or through the air on dust.

Like other forms of life, bacteria are attacked by smaller forms. A group of small viruses cause disease in bacteria and may kill them. Bacterial viruses are called *bacteriophages*.

Several kinds of bacteria form *spores*. The spore is a resting stage that enables the organism to endure adverse conditions. Some kinds of bacterial spores are the toughest living things known. They can withstand boiling water, extreme cold, or chemical poisons for hours without being killed.

Their Significance in Nature

Decay is brought about chiefly by vast armies of saprophytic bacteria, though larger fungi contribute to the process. If there were no decay, the remains of dead plants and animals and the waste of cities



SPORES—A RESTING STAGE

Tough spores are forming inside these bacilli. Bacteria stop multiplying in the spore stage, which may last for years.

would accumulate so fast that they would soon interfere with the life of new generations. The saprophytes also enrich the soil by returning minerals to it and release carbon dioxide into the air for plants to use. Thus the balance of nature is maintained.

All plants need nitrogen to grow. The air is almost 80 per cent nitrogen, but green plants cannot use it in the gaseous form. Fortunately there are several kinds of bacteria that take nitrogen from the air for their own growth requirements and incorporate it into the protein of their cells. In this form the green plants can use it. This change is accomplished by the *Azotobacter*, which are free-living bacteria, and the *Rhizobia*, which live within the roots of legumes. If one carefully digs up a clover root, he will see on it little nodules, inside of which are the *Rhizobia*. (See also Nitrogen, Soil, Clover, Alfalfa.)

How Bacteria Cause Disease

Disease-producing bacteria may enter the body through the mouth and the nose or through cuts in the skin and the bites of animals. In the body they may multiply sufficiently to bring on an illness. Illnesses caused by bacteria and other microorganisms are called infections. Plants and animals as well



HOW BACTERIA BECOME SICK

Small as they are, bacteria are attacked by still smaller microorganisms. At the left is a healthy cell, about to divide. Four



hours later (right) it is diseased. The bacterial viruses (bacteriophages) that are attacking it look like small tadpoles.

as human beings may suffer from infectious diseases.

The infection may be caused by the microorganisms themselves or by their poisonous waste products, called *toxins*. The toxins are often more dangerous than the bacteria themselves. Fortunately the body produces defenses against both. *Antibodies* combat the microorganisms. Other antibodies, called *antitoxins*, combat the toxins. (See Disease.)

Disease bacteria could be used in war to spread disease among people and to destroy livestock and farm crops. Water systems could be poisoned by bacterial toxins, which are the most powerful poisons known. During World War II both sides studied the use of microorganisms in warfare. This research continued after the war, although biological warfare may never be practiced. It is dangerous to the user as well as to the enemy.

Bacteria as Fighters of Disease

Medical science makes use of both the disease-producing bacteria and their toxins. It has been found that when bacteria are killed and then injected into the human body, the body will produce the same antibodies that it forms to protect itself against live bacteria. Such preventive inoculations are called *vaccines*. The antibodies will protect only against the kind of disease bacteria from which the vaccine was made.

Antitoxin injections contain preformed antibodies. They are prepared by injecting bacterial toxins into the blood of live animals. The blood is then collected and the serum is separated from it by chemical means. Antitoxins act more quickly than vaccines, but the protection usually lasts no more than a few weeks or months. Vaccines, however, protect for a year or longer. (See also Antitoxins; Serum Therapy; Vaccines.)

Some kinds of microorganisms secrete germ-fighting



TAKING A SAMPLE OF BACTERIA

A technician has removed the cover from a Petri dish and is taking a sample of the culture for examination.

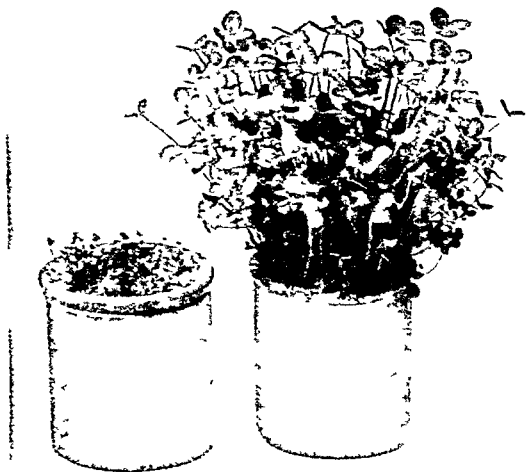
drugs which we call *antibiotics*. These drugs save thousands of lives yearly. Penicillin, the best-known antibiotic, is the product of a mold. Bacitracin and polymyxin are made by bacteria. The majority of commercially available antibiotics come from *actinomycetes*, a group of microscopic plants closely related to bacteria. The actinomycetes are often described as moldlike because they have some of the characteristics of molds. However, it is generally believed that they are more closely related to bacteria than to molds. Among the antibiotics made from them are streptomycin, Aureomycin, Chloromycetin, Terramycin, neomycin, erythromycin, and tetracycline.

A Nuisance and a Help in the Food Industry

The bacteria that bring about decay are the chief cause of food spoilage. For fresh foods, the decay process may be slowed down by refrigeration or checked by freezing. When frozen food is thawed, however, the bacteria become active again.

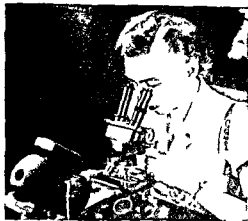
Many kinds of bacteria can be killed by heat. Very few bacteria grow in acid foods, dry foods, salted foods, or very sweet foods. It is comparatively easy to can tomatoes because they are acid. Jams, jellies, and preserves are protected by sugar as well as by their acid content. The amount of heat required to can nonacid foods successfully is very high because of the need to destroy the thermophilic bacteria and the very tough bacterial spores. (See also Food Preservation.)

The chemical changes brought about by a certain group of microorganisms is called fermentation. This group is used to produce fermented foods and beverages. Sour milk and cream, buttermilk, and yoghurt are produced by bacteria that change milk sugar into acid by fermentation (see Milk). The many varieties of cheese owe their flavors almost entirely to different kinds of combinations of bacteria. Corn is changed into silage by bacteria that turn plant sugars into acids - Alcoholic beverages are usually fermented



CLOVER NEEDS BACTERIA TO GROW

The clover at the left is stunted. That at the right was inoculated with *Rhizobium*, which supplies nitrogen to the plant.



COUNTING BACTERIA IN THE LABORATORY

The woman is counting bacteria under the high magnification of a compound microscope. The man is using the cultural method



by yeasts rather than by bacteria. (See also Fermentation Enzymes)

Bacteria in the Chemical Industry

Fermentation is important also to the chemical industry. To prevent mixtures of microorganisms a single parent bacterium is selected in the laboratory. From this cell the strain is grown in large quantities.

The solvents butyl alcohol (used in lacquers) and acetone are formed by the bacterium *Clostridium* growing on corn mash, potatoes or molasses. *Lactobacillus* makes lactic acid from milk sugar or other carbohydrates. The *Acetobacter*, a useful group, make acetic acid (vinegar) from alcohol. They make fructose, a very sweet sugar, from mannitol (a complex naturally occurring sugarlike alcohol). They also make sorbose from sorbitol, another sugarlike alcohol. Sorbose is a sugar used to make ascorbic acid (vitamin C). Dextran, used as a blood plasma substitute, is made by *Leuconostoc* from sucrose, common table sugar. A group of spore-forming bacteria called *Bacillus* produces vitamin B₁₂, the red vitamin which helps blood disorders. (See also Alcohol, Sugar, Vitamins)

Bacteria in the Laboratory

The substance on which bacteria are grown in the laboratory is called a *culture medium*. The food is prepared in liquid form. Usually the bacteriologist adds to it a solidifying agent to make the mixture a semisolid. Gelatin may be used for this, but agar agar (obtained from seaweeds) is more frequently employed. The bacteria grow on the surface of the jellylike culture medium and spread into colonies that are easily seen.

The foods most commonly used are water extracts of lean beef, peptones, which are digestion products of proteins, and a little sugar such as glucose. Whole blood or blood plasma is frequently added to cultivate the kinds that do not grow so readily. How-

ever, there is no limit to the varieties of food that support the many specialized types of bacteria.

The identification of bacteria is often difficult. In general, three classes of information are needed: (1) microscopic observations of size, shape, and appearance when stained; (2) the appearance of colonies on different media; (3) the chemical changes that the bacteria are able to bring about as they multiply. There are many known kinds of bacteria that have been studied very little, and undoubtedly there are hundreds yet to be discovered.

Bacteria are versatile helpers in the laboratory. Many of them use the same vitamins that human beings or animals require. The amount of vitamin in a given medium can be measured under carefully controlled conditions by the extent of the multiplication of a particular kind of bacterium (usually a *Lactobacillus*). Amino acids, the building blocks of proteins, can be similarly measured. Antibiotics are measured by the number of bacteria that are prevented from multiplying. A few dozen test tubes of growing bacteria can measure in several days what would require many weeks and hundreds of animals to accomplish.

BADGER Those who see a badger for the first time are always impressed by the extraordinary flatness of the animal. Its grayish body is about two feet long and seems about a foot wide because its long shaggy hair sticks out at the sides. Even its black-striped head and its short tail are broad, flat, and close to the ground.

The overhanging hair usually hides the badger's short legs so that the animal appears to travel on its stomach like a huge caterpillar. But those concealed legs are equipped with powerful feet and long claws that make the badger a champion digger and dangerous in a close-up fight.

Kenneth Grimme in his whimsical book "The Wind in the Willows" pictured the badger as an animal of very definite purpose, as one in the habit of over-

coming tremendous obstacles. In real life the badger is actually a very determined being. It is clumsy; it cannot climb trees to avoid danger; neither can it swim or run very fast. Yet it survives because of its shrewdness, its courage, its strong muscles, and its ability to dig itself into the ground in a hurry. Surprise one away from its burrow some time and you will see. When you first approach, it will lie flat and pull its legs and head beneath its body, hoping to be unobserved. In this position it resembles a large tuft of withered grass. But when you come nearer it will get into action and start digging furiously, sending a geyser of earth high into the air. Where the soil is fairly soft it will be out of sight very quickly. If you come very close before it is underground, it will turn to fight, snarling and hissing.

The cruel sport of "badger-baiting," in which a single badger was pitted against several dogs, was once common in England and the United States. From this practice we get the word *badgering*, meaning "persistent annoying." The jaws of the badger are so hinged that they can maintain their grip with great tenacity, and the animal is difficult to kill because of its exceptionally muscular body and its thick coat and loose skin.

A GOOD WAY TO STUDY THE BADGER



To show clearly the features of a badger, a museum exhibit like this one is necessary. If he were alive, this unsociable animal would be digging himself in so fast and with such a cloud of dust that you could see very little of him.

The young of the badger are born late in spring, each litter ranging from one to five. As soon as they are old enough, the cubs sally forth with their parents on their nightly hunts, for badgers rarely hunt by day. With their claws they lay open the burrows of prairie dogs, ground squirrels, gophers, and field mice upon which they feed. They also eat ground-nesting birds and their eggs, small snakes, frogs, lizards, and insects.

Badgers are native to North America, Europe, and Asia. They hibernate in cold climates, but where warm winters are the rule they remain active the year round. Badger fur is valuable. It is used for trimming women's coats and in the manufacture of

artists' brushes. Badgers belong to the weasel family (*Mustelidae*), which also includes skunks, otters, minks, martens, and wolverines. The scientific name of the American badger is *Taxidea taxus*; of the European badger, *Meles taxus*.

BAGHDAD, IRAQ. For 4,000 years Baghdad has stood at the crossroads of great world highways of trade. The fertile plain of Mesopotamia, in which it lies, has been crossed since time immemorial by caravan routes connecting the Mediterranean ports with the Persian Gulf, and Turkey and southeastern Europe with Persia and the Far East. Where these routes met, on the banks of the Tigris River, 350 miles north of the Persian Gulf, a city grew up. After it was made the capital of the Mohammedan caliphs, in the 8th century A.D., it became the largest and most beautiful city in the world. The great caliph Harun-al-Raschid, poet and scholar, contemporary of Charlemagne, made it the center of the world's art and learning. Hence it came to be called the "glorious city." It is known to all lovers of romance as the scene of many of 'The Arabian Nights' tales.

Later the city suffered a long decline. Civil wars and repeated sackings by Mongols, Turks, and Persians humbled it. When ocean routes around Africa were discovered, much of its trade was lost. By 1633,

when it became a part of the Turkish Empire, its population had been reduced from 2,000,000 to 14,000. At the end of the 19th century Germany, hoping to dominate the Near East, obtained from Turkey a concession to build a railroad through Turkey to Baghdad. Before its completion the first World War broke out. In March 1917 the British occupied Baghdad, ending Turkish rule and ending also, for the time, Germany's "Berlin-to-Baghdad" dream.

After becoming the capital of the kingdom of

Iraq in 1920, Baghdad entered a new and more prosperous era in its history. In 1940 the last link in the Berlin-to-Baghdad railway was completed under British auspices. An extension of the line terminated at the port of Basra on the Persian Gulf. The airport at Hinaidi is an air center of the Orient and the nucleus of a rapidly growing suburb. With modern transportation Baghdad is regaining its old standing as a center of trade between East and West.

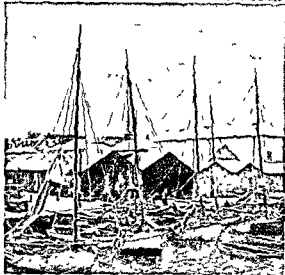
Baghdad is no longer the picturesque city of Harun-al-Raschid's time. A railroad station stands near the spot where that ruler built his beautiful palaces and gardens. The flat-roofed houses of sun-dried brick and the many ancient mosques still stand in

a maze of narrow, winding alleyways. But the British in 1917 built a modern street straight through the city and unromantically named it New Street. Other paved streets have followed, and streetcars, taxicabs, electric lights, a modern water system, and a museum of Mesopotamian antiquities speak eloquently of Western progress. Even the fascinating covered bazaars are invaded by the wares of Europe. The city's population is 364,049 (1947 census). About one fifth are Jews, descendants of the people who were carried away into the Babylonian captivity by Nebuchadnezzar. (See also Iraq Mesopotamia.)

BAGPIPE. This reed instrument has a long history. It is spoken of in the Old Testament and it was used by Egyptians, Greeks, and Romans. During the Middle Ages it was one of the popular instruments of the troubadours. Today it is the national instrument of the Scottish Highlanders, and pipers are attached to Highland regiments in the British army.

The Scottish Highland bagpipe has a large leather bag which the player inflates by blowing through its valved tube (blowpipe). The bag serves as a reservoir to supply wind continuously to its reedpipes—three pipes of fixed pitch, called *drone*s, that sound continuously during playing, and to the "chanter," or "chaunter," with six to eight finger holes on which the melody is played. The drones have single reeds, like the clarinet reed; the chanter, a double reed like the oboe reed. The German *Dudelock* is blown like the Scottish bagpipe. The French *musette*, the Italian *surdellina* and the Irish *union pipes* get their wind from bellows pumped by the player's arm. Bagpipe music is full of difficult flourishes and graces that test a piper's skill.

SPONGE BOATS MOORED AT A BAHAMA DOCK



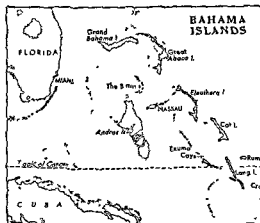
At a Nassau dock these Bahama sponge boats are ready for an expedition into the blue waters of the Caribbean and the Atlantic. Behind the dock are warehouses for the sponges, one of the islands' chief exports.

World. Watling Island, the outermost of the group, was probably the one that Columbus discovered and named San Salvador.

The archipelago is a British crown colony. It consists of about 3,000 low islands and rocky islets. These form a line 600 miles long reaching from a point off the east coast of Florida nearly to the island of Hispaniola. Through this island barrier there are but three channels for large vessels, for the islands are merely the exposed peaks of a great submarine mountain range. There are no running streams, except on Andros, the largest island. Fresh water is supplied by wells dug in the soft rock.

The climate is mild, with an average winter temperature of about 70° F. Nassau, the capital, on New Providence Island, is a popular winter resort. Fruits and vegetables are grown. Pigs, sheep, goats, and turkeys thrive. The chief exports are sponges, tomatoes, pine timber, cascarilla bark, sisal, salt, and

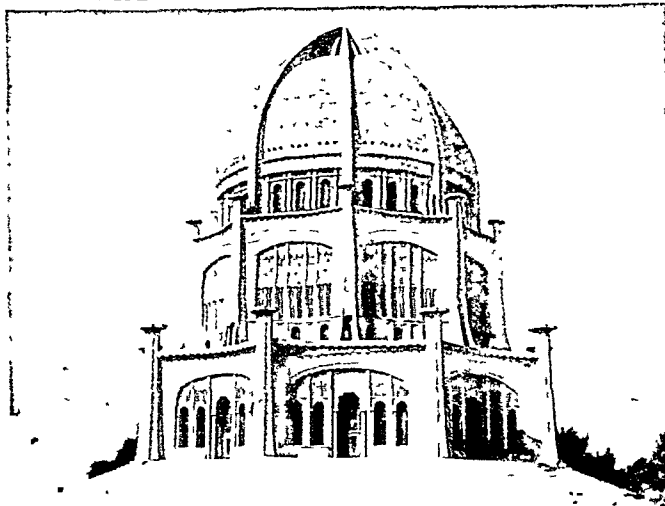
tortoise shell. The area of the 20 inhabited islands is about 4,400 square miles. A site on Exuma Island, near the center of the chain, was leased by the United States in 1941 as an air and naval base to improve defense of the Caribbean. Population (1948 est.), 76,000, mostly Negroes.



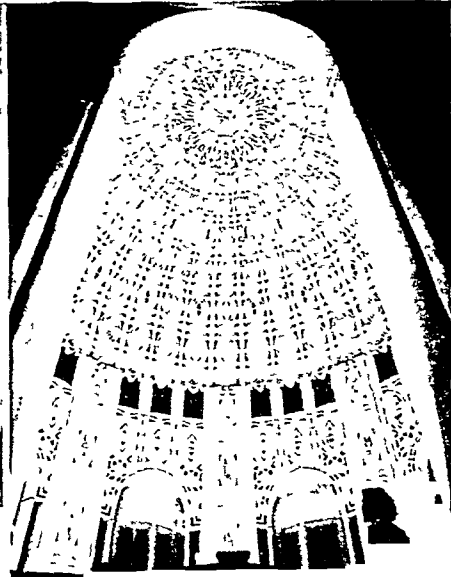
Only 52 miles from Florida, begin the Bahamas. Nassau, the capital, lies but two air hours from Miami. Columbus first touched America at Watling Island, which he named San Salvador.

BAHAMAS (ba-hā-māz) Columbus made this group of islands in the West Indies famous, for it was on one of them that he first touched the soil of the New

THE NINE-SIDED BAHAI TEMPLE AT WILMETTE, ILLINOIS



Overlooking Lake Michigan stands the beautiful Baha'i Temple, national center for the American Baha'is. The concrete and steel building is covered with lacelike ornamentation made of molded cement and crushed quartz. The view at the right shows the interior dome as seen from one of the upper balconies.



BAHA'U'LLAH (*bā-hā'q-lā'*) (1817-1892). In 1844 a new religion was born in Iran. Its founder, who was called the Bab (meaning "the gate"), soon gathered many converts. In 1850 the Bab himself was put to death because he defied the Islamic authorities. But he had predicted that a new leader would arise, one even greater than himself. In 1863 a saintly teacher and prophet of the new faith revealed himself as God's chosen head of the Baha'is, as they are now called. His name in the religion was Baha'u'llah (Glory of God). Members of the Baha'i faith revere Baha'u'llah as "the divinely appointed Mediator between God and man."

Baha'u'llah was born in Tehran, Persia (now Iran), on Nov. 12, 1817. His real name was Mirza Husayn Ali, and he was the eldest son of a wealthy minister of state. Early he showed a deep understanding of spiritual problems and chose to follow a religious vocation rather than to succeed his father in a state post.

When the Bab declared his mission, Baha'u'llah became one of his most ardent followers. He suffered imprisonment and exile for his faith; and after the Bab was executed he became one of the movement's most beloved teachers. In 1853, while being held in a dungeon, Baha'u'llah underwent a spiritual experience that convinced him of his future rôle. Finally at Ridvan, near Baghdad, and after a series of revelations, he declared that he was the leader whose coming the Bab had foretold. His followers joyously accepted him, but the Moslem world was still hostile. For many years the Baha'is were held in semi-imprisonment in Akka (Acre) in Palestine, and only gradually were restrictions lifted.

Baha'u'llah's teachings spread, and thousands of people in many nations became Baha'is. When Baha'u'llah died, May 29, 1892, his testament appointed his son Abdul Baha (Servant of Baha) to carry for-

ward his work. Abdul Baha left a testament designating his grandson Shoghi Effendi as "guardian of the faith." He also established the form of Baha'i world administration. Today there are Baha'is in more than 100 countries, with more than 2,500 local Baha'i centers. In the United States the national Baha'i center is maintained at Wilmette, Ill., the site of the Baha'i Temple.

BAIKAL (*bī-kāl'*), LAKE. With a depth of 5,400 feet, Lake Baikal in southern Siberia is the deepest freshwater lake in the world. It is also the sixth largest. It is about 390 miles long and from 20 to 50 miles wide, with an area of 13,200 square miles. Ringed by the Baikal Mountains, a spur of the Altai Range, the lake is fed by countless swift streams. The largest is the Selenga River. The lake's chief outlet is the Angara River, which flows into the Yenisei. *Baikal* means "rich lake," and it abounds in fresh-water seals, sturgeon, salmon, and herring. It bears considerable trade—in "open weather," in steamships; and when the lake is frozen, over the ice.

BAKING POWDER. The purpose of baking powder is to blow bubbles through cakes and biscuits to make them light. It contains an alkali and one or more acid salts. The alkali is always sodium bicarbonate (ordinary baking soda). The acid salt may be monocalcium phosphate, or potassium acid tartrate (cream of tartar), or an alum, usually sodium aluminum sulphate (see Alum). When moistened the acid salts react violently with the alkaline baking soda (see Acids and Bases), causing it to release bubbles of carbon dioxide gas. To keep it from working while still in its package, baking powder contains cornstarch, which absorbs the moisture from the air that comes in contact with the powder.

In use, baking powder is thoroughly mixed with the flour before milk or water is added. The heat of the

baking releases still more carbon dioxide and the cakes or biscuits come out inflated to several times their original size. Indeed two teaspoonfuls of baking powder generate almost a full quart of carbon dioxide at an oven heat of 350°F . Instead of baking powder cooks sometimes use baking soda and sour milk. These form carbon dioxide bubbles by the action of the lactic acid in the milk.

For making ordinary bread yeast is used instead of baking powder. The tiny yeast plants produce the carbon dioxide by breathing. (see Yeast)

BALBOA VASCO NUÑEZ DE BALBOA (1475-1517) Balboa was the first European to look upon the Pacific Ocean from the shores of the New World. This Spanish adventurer

BALBOA'S FIRST STEP TOWARD FAME



I can serve better as a
soldier than as a prisoner
and the runaway

turer and explorer sailed for America in 1500 and settled in Santo Domingo. There his unsuccessful attempts at farming led him into debt. In 1510, hoping to escape his creditors, he stowed away on a ship bound for the new colony of San Sebastián on the mainland of South America. He was soon discovered but his ready eloquence saved him. He convinced the leaders of the expedition that he would be of more use as a common soldier than as a prisoner.

When the adventure at San Sebastián proved a failure, Balboa persuaded his superiors to transfer the colony to Darien (now the Isthmus of Panama). Once there the leaders quarreled among themselves and were deposed. The man who had started out hidden in a cask marked "victuals for the voyage" was left in

command of the expedition. Balboa was at once a bold man and a kindly one. Gaining the confidence and friendship of the natives, he learned of a great ocean beyond the mountains and an abundance of gold to be found there. Balboa believed that a successful expedition to the great unknown sea would win him the favor of the King of Spain, so he set out across the Isthmus of Darien. It took 21 days for his party of 190 Spaniards and 1,000 natives to cross 45 miles of dense jungle. On Sept. 25, 1513, Balboa stood upon a mountain peak and saw the Pacific Ocean, which he called the Southern Sea. Four days later he reached its shores and took possession of the ocean and all lands washed by it in the name of the Spanish monarch.

Balboa expected to be hailed as a great explorer and he dreamed of the glory in store for him. When he returned to Darien, however, he found his absence

had cost him dear. A new man had won the governorship. Conflict arose immediately between the two. In 1517 Balboa was arrested on the false charge of instigating a rebellion and was beheaded.

Balboa has been so overshadowed in literature by the romantic figure of Cortez that even the poet Keats confused the two and in his famous sonnet wrote:

Then felt I like some watcher of the skies
When a new planet swims into his ken.
Or like stout Cortez, when with eagle eyes
He stared at the Pacific—and all his men
Looked at each other with a wild surmise—
Silent, upon a peak in Darien

BALDER (*bāl'dēr*). Among all the gods of Norse mythology there was none so beloved and beautiful as Balder, son of Odin. When he passed it was like the coming of sunshine, and every grief fled before the brightness of his presence. In all his life he had never known a moment of sadness, and the gods vied with one another in showering favors upon him.

One night his sleep was haunted with dreams of disaster. When the gods learned of the dreams, sorrow fell upon them. His mother Frigga roamed the earth, supplicating all living things not to harm her son, and they willingly gave their promise. The gods then rejoiced and once more happiness reigned in Asgard, their habitation. Thenceforth Balder led a charmed life, and on festival days the gods hurled missiles in play at the invulnerable hero, who smiled when darts and stones fell harmless at his feet.

But among the gods was one selfish, jealous being named Loki who wished to put an end to Balder's reign of love. Disguising himself, he sought out Frigga and obtained from her the admission that there was one frail little plant, the mistletoe, whose promise of protection to Balder she had neglected to get. It was so small and so hidden in the oaks of the mountainside that she had failed to visit it.

When he learned this, Loki made a spear shaft out of the oldest, toughest sprigs of mistletoe. Hoder, a blind god, loving Balder and wishing to honor him, consented to throw the shaft, not knowing that it alone of all things was harmful to the beautiful god. Balder fell, pierced to the heart, and his spirit journeyed to the underworld. Sorrowing, the gods pleaded for the release of Balder. The ruler of the underworld consented, provided that every living thing should weep for his return. The whole grief-stricken world immediately began to weep, with the exception of the hateful Loki. So Balder could not be released, and he has dwelt in the underworld from that day to this.

A tiny, aster-like flower with pure white petals, which grows everywhere by the roadside, is called in his honor "Balder's brow." In the Norseland when the dark long winter sets in the people say, "All nature sorrows for Balder." And when the spring breaks forth with budding trees they cry, "The spirit of Balder again roams the earth."

BALDWIN, ROBERT (1804-1858). That Canada is today a loyal and contented member of the British Empire is due in large measure to the far-seeing political wisdom of Robert Baldwin. Elected to the

legislature of Upper Canada in 1829, four years after he began the practise of law in his native town of York (now Toronto), Baldwin came to the front as a champion of responsible government. He insisted that Canada should have a system of cabinet and parliamentary government like that of England, with a legislature elected entirely by popular vote. However, he had no sympathy with the extremists who launched the ill-fated rebellion of 1837-38. (See MacKenzie, William L.; Papineau, Louis J.)

Twice Baldwin was called to the Executive Council, in 1836 and 1841, only to resign on questions involving the principle for which he was fighting. At last, in 1842, after the union of Upper and Lower Canada, he formed, with Louis Hippolyte LaFontaine, the first administration to accept responsible government. Disagreement with the governor-general soon led to their resignation; but in 1848 Baldwin and LaFontaine were again returned to power, and the principle for which they had fought so courageously was finally established. When in 1851 the radical wing of his party gained the ascendancy, Baldwin, always a moderate, resigned. The rest of his life was devoted to bringing about a better understanding between the English and the French sections of Canada.

BALEARIC (*bāl-ē-ār'ik*) ISLANDS. The sunny Balearic Islands in the western Mediterranean are smaller than the state of Delaware. But their key position has often made them prizes of war. Lying nearly midway between North Africa and southern France, they command the north-south ship and air routes across the western Mediterranean.

Today they are a Spanish province, *Islas Baleares*. They are a loose group of five small islands and ten islets and form a slightly curving archipelago about 190 miles long. In order of size, the five islands are Mallorca (or Majorca), Menorca (or Minorca), Ibiza, Formentera, and Cabrera. Nearest to the mainland is Ibiza, about 60 miles off the east central coast of Spain.

The mild climate and rare beauty of the islands attract many tourists. Palm-fringed coasts sheer up to wooded hills. On the terraced, irrigated slopes cling olive groves and orchards of figs, lemons, oranges, and almonds. Much of their yield is shipped to Spain. Other major exports include fish, sea salt, some textiles, and fine handmade shoes from Menorca.

Palma (Mallorca), the capital and largest city of the Balearics, is a cosmopolitan tourist center. On Menorca, about 25 miles east, is Mahón, one of the best harbors in Europe. During the French occupation of Mahón (1756-63), a delicious native sauce so pleased the soldiers that they introduced it to Paris, where it was named *mayonnaise*.

In ancient times the people of the islands were so expert in use of the slingshot that they came to be called *Baleares*. from the Greek word *ballein*, "to throw." The islands were seized successively by the Carthaginians, Romans, Vandals, Normans, and Moors. By 1235 they had been conquered by Spain. In 1276 they became a vassal kingdom, but were taken back by Spain in 1349. During the wars of the 15th century they were captured by France and by England, but were ceded to Spain by England in 1802. Area, 1,935 square miles; population (1950 census, preliminary), 422,127.

The RUGGED BALKANS and Their TROUBLED PEOPLE



Crumbling feudal castles dot the country in the Balkans, symbols of an age not long past. The peasants who live in this little village in the mountains own each a few acres in the valley or on the terraced hillside. The soil is poor and the farms are small, but the Balkan peasant is satisfied if he can grow enough to feed his family and have a small surplus.

BALKAN PENINSULA Half a dozen small countries are crowded into the Balkan Peninsula in the southeastern corner of Europe. A peninsula is usually thought of as a land area that is nearly surrounded by water. Thus desertion fits the lower tip of the Balkan Peninsula where Greece looks out over the Mediterranean and the sea is within easy reach of every part of the land. But between the head of the Adriatic and the Black Sea the Balkans spread out into a broad continental mass 800 miles wide which merges into central Europe.

There is not even a mountain barrier to separate the peninsula from the mainland for the broad valley of the Danube crosses it in the north. Below this however the country is wild and rugged. Balkan in fact is a Turkish word which means mountains. The narrow Balkan range for which the peninsula was named rises below the Danube Valley and farther south the Rhodope Mountains spread to the Aegean. The main chain of the Alps bends down the west coast continuing to the southern tip of Greece. This chain is called the Dinaric Alps where it follows the Adriatic and the Pindus Mountains farther south.

The climate is rigorous in the north with heavy snowfalls but mild and sunny in the south. The richest areas are the broad plain of the Danube and the smaller valley of the Maritsa. Elsewhere the rivers are short and the valleys small.

In the east the Balkan Peninsula almost touches Asia at the Bosphorus and the Dardanelles. Istanbul at the narrowest point of the Bosphorus is only a mile from Asia Minor. Across here as well as over the

broad Danube highway migrating peoples and armies have marched since time immemorial and many different peoples remained to settle in the fertile Balkan valleys. Both European and Asiatic empires have left the imprint of their civilizations and religions.

The modern Balkan countries are small and densely populated. An area not much larger than Texas holds 50 million people. In all countries most of the people are farmers and the standard of living is very low. Manufacturing and mining are little developed. Since the second World War Communist governments have held power in Yugoslavia, Albania, Rumania, Bulgaria, and Hungary. The only exceptions to this domination are Greece and European Turkey.

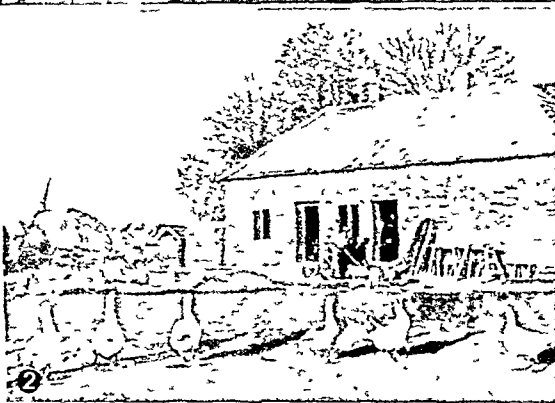
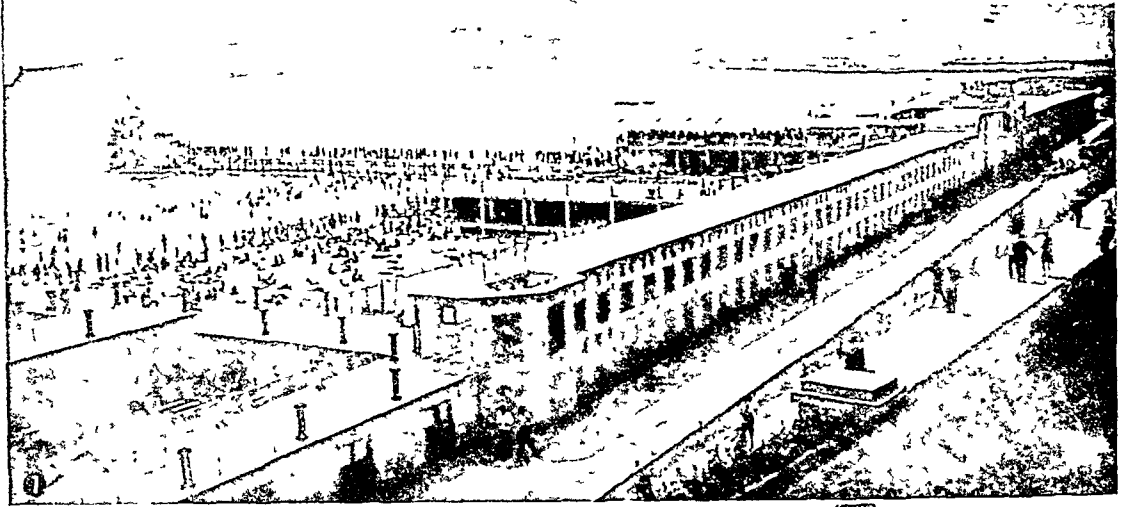
Most of the People are Slavs

The greatest migrant was that of the Slavs. Today they make up a majority of the population. The mountain ranges split them up into isolated groups and in the course of time each group has developed its own distinctive culture and language.

The main Slavic groups today include the Serbs, Croats, Slovenes, Bulgarians, Macedonians, and Ruthenians. The Romanians, Hungarians, and Greeks have all absorbed some Slavic blood but do not speak Slavic languages. The Albanians are a distinct and ancient group. Among all these peoples live many Turks (who invaded the peninsula in the Middle Ages) and numerous Jews, Germans, and gypsies.

Because of the conflicting aims of its various peoples, war has been the usual state of affairs in the Balkans, and peace only an occasional interlude. The Great Powers fearful lest their rivals should

NEW AND OLD WAYS OF LIVING IN THE BALKANS



Modern sights and ways mingle with age-old customs throughout the nations of the Balkan region. 1. The Black Sea bathing beach at Varna in Bulgaria is highly modern. 2. So is the brick and tile structure being built on a Balkan farm. 3. But old costumes and ways appear in this glimpse of Yugoslav women husking and shelling corn. 4. A young Yugoslav housewife is spinning by hand. 5 and 6. A garlic vendor in Bucharest and a lemonade seller in Belgrade are typical peddlers.



The broad plain of the Danube spreads over the north of the Balkan Peninsula. Mountains cover the rest of the land, and reach up to cut the great plain into two parts. In the east the peninsula stretches out and almost touches Asia.

gain control of this strategic region, have added fuel to the fire. Even before the first World War was touched off there, the peninsula was known as the "powder keg" of Europe.

Wave After Wave of Migrations

At the time when the civilization of ancient Greece was flourishing on the tip of the Balkan Peninsula, the people to the north were known as the 'bar-

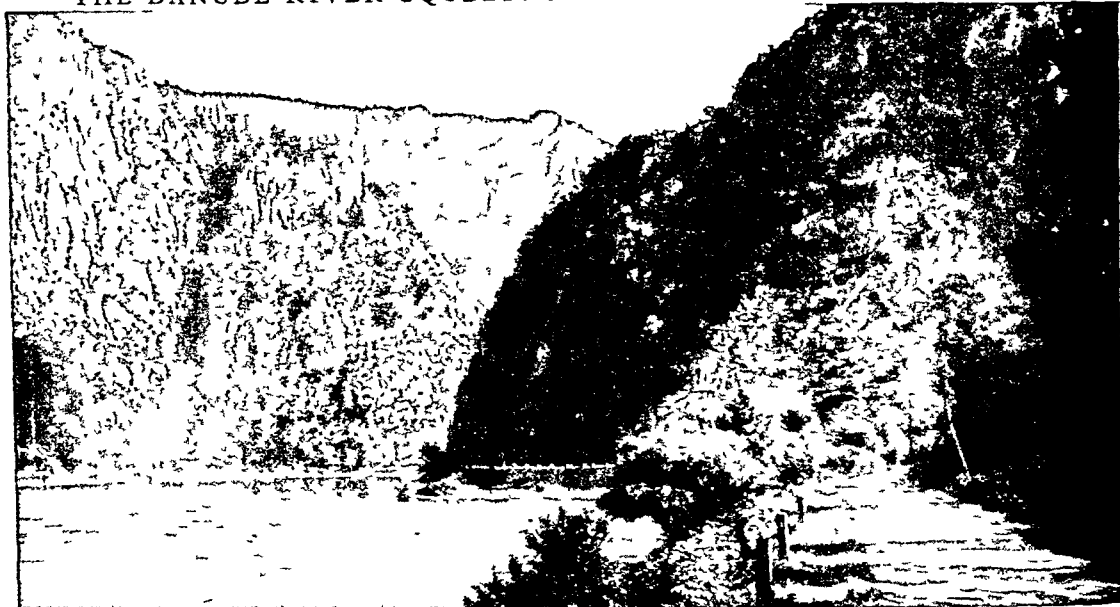
barians.' Those to the east were called the Thracians, those to the west the Illyrians, and in the center the Macedonians. Macedonia, under Alexander the Great, became for a while the nucleus of a great empire (see Alexander the Great, Macedonia). Then Rome conquered the peninsula, bringing to the people of the interior the Roman civilization and the Latin language. Visigoths and Ostrogoths ravaged the country, but

passed through and made little impression. In the third century the great Slav migration began, coming from what is now Poland and western Russia. For four centuries Slavic tribes continued to pour in until they had occupied all the little valleys below the Danube. The Greeks were pushed back to the coast. The Thracians (later called the Vlachs) took refuge in the

in common and they paid taxes to their lords in workdays and in grain.

The Balkan peoples were, however, converted to the Christian religion. Those who settled in the region dominated by the Byzantine Empire from its great capital at Constantinople (now Istanbul) adopted the Orthodox Eastern religion. Those in the west (the

THE DANUBE RIVER SQUEEZES THROUGH THE KAZAN DEFILE



Leaving the great Hungarian plain behind it, the Danube channels through the precipitous black cliffs of the Kazan Defile. Farther on it emerges at the Iron Gate and spreads out again to wind over a broad valley on its way to the Black Sea.

mountains and became nomadic shepherds. The ancient Macedonians became extinct. But the Illyrians, on the south coast of the Adriatic, held off the invaders and maintained themselves in the hills of Albania. In the Danube Valley too the original population survived. Here the Rumanians claim to be descended from the Romans, as their name indicates. But although they speak a Latin tongue, they have a large proportion of Slavic blood.

In the seventh century, when the Slavs were already established in the peninsula, an army of slant-eyed yellow men called Bulgars marched in from eastern Russia. But they were few in numbers and the Slavs assimilated this new race. The only reminder of their conquest today is the name of Bulgaria.

Then in the ninth century the Magyars swarmed in from the east and made their home in the broad Hungarian plain. These fierce warriors had Finnish and Mongolian blood. But in the course of time they too blended with the Slavic peoples, and little trace of their Asiatic origin remains in the Hungarians today.

The Slavs did not adopt either Greek or Roman speech and customs. They continued to live in their ancient tribal fashion, organized in large family groups of a hundred or more people. They built no great cities, but lived in wattle huts in little villages. The members of the tribe tilled the land

Hungarians, the Croats, and the Slovenes) became converts in the Church of Rome.

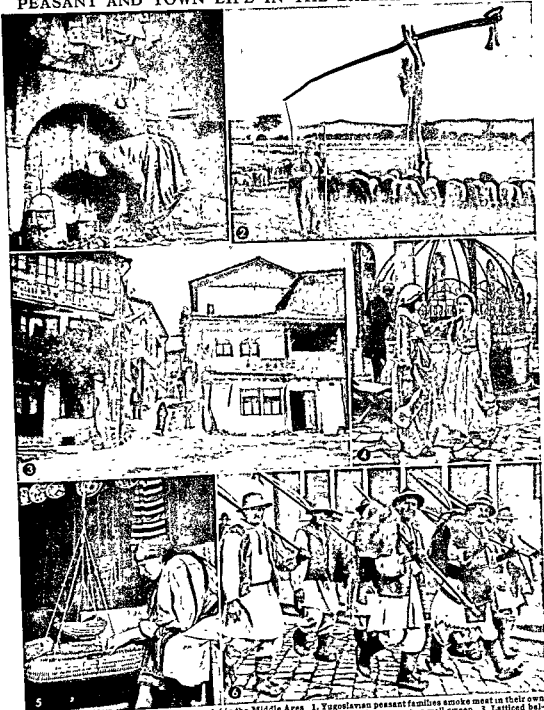
For centuries the power of the Eastern Roman Empire had been waning. In the Middle Ages the Turkish cavalry crossed the Dardanelles to the Balkans. Constantinople fell in 1453, and the Moslems soon swept on to conquer the entire peninsula. Mohammedan lords now occupied the feudal castles.

The "Powder Keg" of Europe

For nearly five centuries the peasants suffered under the oppressive rule of the Turks. Then, in 1804, revolt blazed up in Serbia. This touched off insurrections which spread to Greece and then all over the peninsula. In the 19th century new names appeared on the map of Europe as one by one the Balkan peoples threw off the Turkish yoke and organized themselves into national states. For more than a century the wars of liberation went on, sometimes helped and sometimes hindered by the Great Powers.

Russia hoped to crush Turkey and so gain control of the outlet from the Black Sea. It fostered a movement called "Pan-Slavism," which aimed at the union of all Slavs under the protection of Russia, the greatest Slav nation. England feared that if Russia gained control of the Bosphorus and the Dardanelles England's Mediterranean route to the east would be in danger, and so supported Turkey against Russia. Austria,

PEASANT AND TOWN LIFE IN THE BALKAN COUNTRIES



The Balkan peasants still live much as they did in the Middle Ages. 1. Yugoslavian peasant families smoke meat in their own homes, as this woman is doing. 2. A Bulgarian sheep herder gathers his flock under a primitive well sweep. 3. Latticed balconies and dusty unkempt streets are everywhere, as in this Bulgarian town. 4. Two girls of Sarajevo, Yugoslavia, draw their water from the covered city well. 5. A Hungarian woman rocks her baby in a homemade cradle, with a smaller doll's cradle hung above it. 6. These Rumanian peasants are carrying scythes to the fields to harvest the crop.

which had annexed the Turkish province of Hungary, was eager for more spoils. And Germany dreamed of "Drang nach Osten" (march to the east) and the construction of a Berlin-to-Baghdad railway.

Russian ambitions were blocked by England in the Crimean War of 1853-56 (see Crimean War). Russia tried again in 1877-78, when it successfully aided the Serbs and Bulgarians against the Turks. England at once called the European powers to the Congress of Berlin (1878) and the resulting treaty left Turkey still with a wide strip of land reaching to the Adriatic Sea, including the province of Macedonia.

In 1912 a Balkan League was formed against Turkey by Bulgaria, Serbia, Greece, and Montenegro, with the object of freeing Macedonia. The first Balkan War followed immediately. The weak Turkish forces were quickly defeated, and Turkey was left with only a small area of land around Constantinople.

The Peace of London (1913) awarded the lion's share of the spoils to Bulgaria; and the Balkan League at once exploded. The second Balkan War broke out, with Bulgaria fighting to retain its possessions against Serbia, Greece, Montenegro, and Rumania. Peace was signed at Bucharest August 1913. Macedonia was now divided among Greece, Serbia, and Bulgaria.

Only Greece was satisfied with its new boundaries. Jealousy and distrust persisted among the Balkan States; and they continued to look to rival European powers to bolster up their conflicting claims. The Pan-Slavs of Serbia, supported by Russia, demanded

an outlet to the Adriatic Sea. Their claim was opposed by Austria-Hungary, which had annexed the disputed territory (Bosnia) in 1908.

The First World War Begins in the Balkans

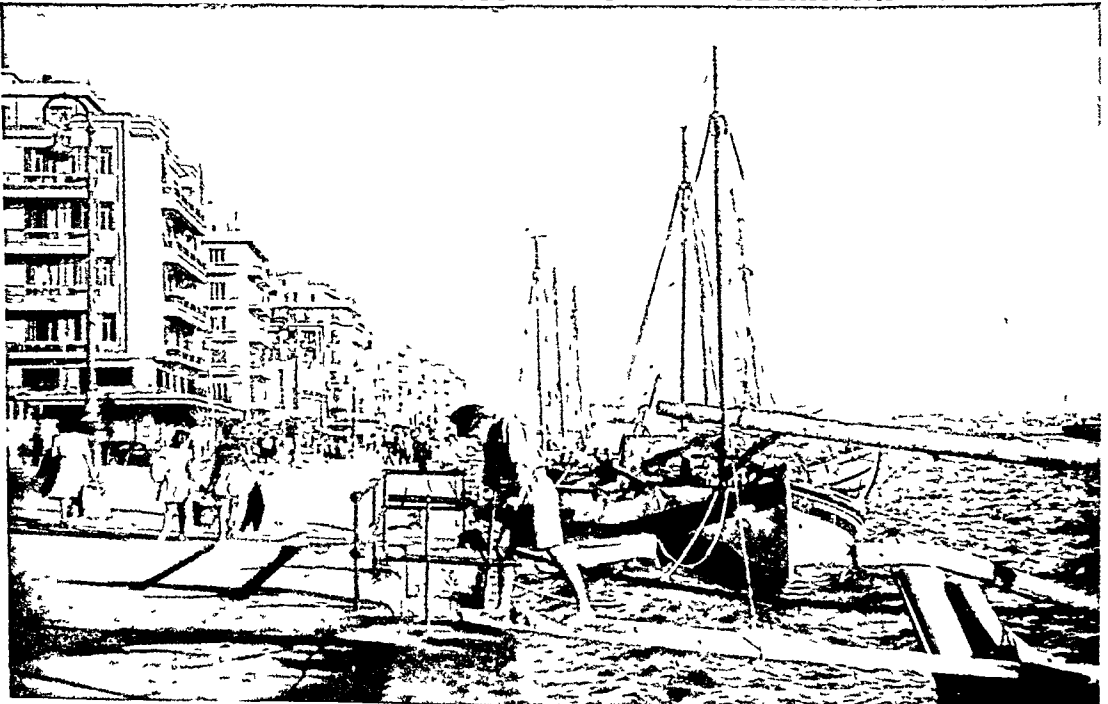
A Serbian conspiracy resulted in the murder of the Archduke Francis Ferdinand of Austria at Sarajevo, in Bosnia, in June 1914. This was the spark that touched off the first World War. Austria-Hungary declared war on Serbia, and Russia came to Serbia's aid. The rest of Europe was quickly involved (see World War, First). Turkey and Bulgaria joined the Central Powers. Montenegro, Rumania, and Greece fought with Serbia on the side of the Allies.

After the war a new Balkan state was created out of Serbia, Montenegro, and parts of Austria-Hungary (see Yugoslavia). Rumania was doubled in size. Greece made considerable gains, but was still dissatisfied; so it attacked Turkey in 1921. Turkey threw back the invasion and in the Treaty of Lausanne (1923) regained some of its old territory (see Greece). To protect their territorial gains, Rumania and Yugoslavia joined with Czechoslovakia to form the Little Entente in 1921-22. A new Balkan league was formed in 1934 when Turkey, Greece, Rumania, and Yugoslavia signed the Balkan Pact. After 1933, the Balkan States were forced to sign pacts giving Germany a virtual trade monopoly.

Balkan Nations in the Second World War

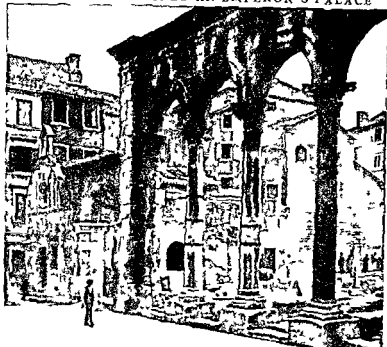
In April 1939, Italy seized Albania. In September the second World War began. Germany and Italy invaded

THE AEGEAN PORT SOUGHT BY RIVAL BALKAN NATIONS



Saloniki is the chief port on the north Aegean Sea. Founded in 315 B.C. as Thessalonike, it has passed from one nation to another. It now belongs to Greece. Its modernized, gleaming marble buildings tower above a broad concourse and the historic waterfront.

TIME HAS DARKENED AN EMPEROR'S PALACE



Much of the magnificent stonework of Diocletian's palace (begun A.D. 295) still stands in Sofia, Yugoslavia. The town actually grew up within the walls of the old palace in the Middle Ages.

Greece in 1940 and Yugoslavia in 1941. They met fierce resistance in both countries but conquered them. Hungary, Bulgaria and Rumania were forced to ally themselves with Germany in 1941.

In 1944-45 the Russian army drove the Nazis out of Rumania, Bulgaria and Hungary. With the aid of Allied supplies Yugoslavia freed itself under the Communist leadership of Marshal Tito. Greece and Albania were aided by Allied forces.

People's Republics in the Balkans

Aided by Russia's military occupation Communist minorities seized power in all the Balkan nations except Greece and Turkey. Kings were forced into exile and Communist people's republics were set up. The new governments were patterned after the Soviet government and took orders from Moscow. Secret police systems modeled on the Russian secret police were forced ruthlessly against all who did not support the new government wholeheartedly—the middle class and well-to-do farmers, popular leaders of the peasants, parties and the clergy. The peasants were forced into co-operative state-owned farms similar to Russia's collectives. Trade and industry also passed from private hands to the government.

The Communist states on the Greek border fomented civil war in Greece in the hope of bringing that country into the Communist bloc—or at least of gaining control of the port in Greek Macedonia (see Macedonia). In spite of aid given by the United States the Greek civil war dragged on until the Communist guerrilla forces admitted defeat in 1949.

Meanwhile the Communist bloc was split in 1948 when Tito, dictator of Yugoslavia, sought economic contacts with the democracies. He needed the manufactures to develop Yugoslavia. He retained national Communism. Through a 20-year economic pact in 1949 Russia got control of nearly all the trade and industry of its satellite states. Yugoslavia did not join and in 1951 resumed diplomatic relations with Greece. Some Balkan unrest continued. In 1953 Yugoslavia refused to consent to return Trieste to Italy and Greece accused Bulgaria of border infringement. The Balkan Big Three—Turkey, Greece, Yugoslavia—signed a pact in 1953 against Soviet aggression. More progress came in 1954 when Greece

asked the U.N. to remove its frontier watchers as the danger of guerrilla invasion from Albania and Bulgaria seemed passed. (See also articles on each Balkan nation for Reference Outline—see Europe.)

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TRADITIONAL DANCE of the Stage—BALLET

BALLET. The classic dance of the stage—ballet—is loved throughout the Western world. It is the major dance art of the West, the product of many centuries of development and tradition. It attracts large and enthusiastic audiences wherever the arts of the theater are highly developed.

The United States usually has two or three ballet companies that play engagements of a week or more in the larger cities and tour the smaller ones. Local ballet groups exist in a number of cities. Often these are connected with local opera companies, since many operas include ballet numbers. Television introduced ballet to millions of Americans who had not seen it in theaters.

England has subsidized its chief ballet companies, the Sadler's Wells and the Ballet Rambert. In France, the Paris Opéra, a national institution, includes a ballet company and school. Other European countries have privately managed or state-owned companies. Ballet is also popular in Canada and Latin America. Leading ballet companies make international tours.

What Is Ballet?

A ballet is a theatrical performance in which dancing and pantomime, accompanied by music, tell a story or express an idea. Music may provide the subject matter as well as rhythmic accompaniment, for



Above is a pose from a revival by America's Ballet Theatre of 'Pas de Quatre' ('Dance for Four'), first produced in 1845. Standing are Alicia Markova and Karen Conrad; kneeling are Nora Kaye and Annabelle Lyon.

many ballets are interpretations of musical compositions. The art of painting usually contributes through creation of the scenery and the designs for costumes.

A typical program of ballet consists of three individual numbers. Together these take about as much time in the theater as a three-act play. The program may contain a fourth number, often a *pas de deux* (*pā-dē-dy*), or dance for two, from a well-known longer ballet. This is a show piece to display the skill in classical dancing of leading members of the company.

THE CORPS DE BALLET FORMS A GRACEFUL PATTERN



The lovely Fokine ballet 'Les Sylphides' is danced to music by Frédéric Chopin. First produced in 1909, it is a favorite of

audiences everywhere. The picture shows the corps de ballet of the Ballet Theatre costumed in the long "romantic tutu."

Occasionally a three- or four-act ballet occupies the entire program. Examples are revivals in their original form of the fairy tale ballets 'Swan Lake' and 'The Sleeping Princess'.

Major ballet companies have their own symphonic orchestras. Music by the finest composers spectacularly beautiful costumes and scenery the beauty and grace of ballerinas and the marvelous technique and athletic ability of men dancers combine to make a well-done program of ballet one of the most glamorous forms of entertainment.

The Ballets of Today

The repertoire of modern companies contains several ballets which have survived from the 19th century. These include a short version of 'Swan Lake' and two short versions of 'The Sleeping Princess'—'Princess Aurora' and 'Aurora's Wedding'. Marius Petipa created the dance composition (choreography) of these ballets and Tchaikovsky composed the music. Other 19th-century survivals are 'The Nutcracker' (choreography by Lev Ivanov, music by Tchaikovsky) and 'Coppélia' (choreography by Arthur Saint-Léon, music by Léo Delibes). (For a discussion of 19th-century ballets and for the history of ballet, see *Dance*, sections 'Ballet in the Western World' and 'Stage Dance in America'.)

The modern repertoire contains many ballets from the period of 1909 to 1929, which was dominated by the great Russian impresario, Sergei Diaghilev. Michel Fokine, leading choreographer for Diaghilev, created most of them. 'Les Sylphides' (*the sylphs*) is perhaps the best-loved of the Fokine ballets. It is a "white ballet," so called because the girls all wear filmy white costumes. The ballet has no plot; the program calls it a "romantic reverie." Most Fokine ballets are quite different, for Fokine was a reformer who emphasized dramatic action in ballet. Among his most famous works are 'Scheherazade', 'Petrouchka', 'Carnaval', 'Firebird', and 'Specter of the Rose'.

Vaslav Nijinsky, the greatest dancer in Diaghilev's company, created 'The Afternoon of a Faun', in which he introduced jerky, angular movements in place of the traditionally smooth grace of ballet. Another Nijinsky creation was 'The Rite of Spring', with music by Igor Stravinsky.

Leonide Massine, a fine dramatic dancer, was a member of Diaghilev's troupe from 1913 to 1925. Between 1915 and 1945 he created about 50 ballets. 'Gaité Parisienne' has been a favorite. It tells the lively story of a Peruvian's ad-

'SYMPHONIE CONCERTANTE



This grouping by Todd Bolender, Diana Adams and Tanquiel Le Clerq, with its long slender intertwining curves is typical of George Balanchine's choreography. (New York City Ballet.)

ventures in a Paris café with a flower girl, a glove seller, a cancan dancer, a baron, and a French army officer. Other popular Massine ballets are 'The Fantastic Toy Shop', 'Three-Cornered Hat', and 'Le Beau Danube'. Massine created a number of "symphonic ballets," interpreting choreographically complete symphonies by Beethoven, Brahms, and others.

Another Russian, David Lichine, did the choreography for the lively 'Graduation Ball' and 'Fair at Sorochinsk' as well as the more dramatic 'Francesca da Rimini' and 'Cain and Abel'.

The Russians of the Diaghilev Fokine tradition brought drama, color, and gaiety into ballet. They usually took their themes from fairy stories, legends,

folklore, or the romantic literature of the past. It remained for English and American choreographers to create ballets with psychological impact, with characters who seemed like real people.

Among the English, Ninette de Valois was a pioneer. She founded and directed the Sadler's Wells Ballet. 'The Rake's Progress', which interprets the series of paintings of that name by William Hogarth, is among her finest dance creations. Other

SHORE LEAVE IN BALLET



In 'Fancy Free' Jerome Robbins created a carefree, athletic ballet which won instant popularity. The dancers shown here are Harold Lang, John Kira, Jerome Robbins and Shirley Eckl. (Ballet Theatre)

BALLET DEALS WITH MODERN LIFE



Jerome Robbins' 'Age of Anxiety', shown above, was inspired by Leonard Bernstein's second symphony and a poem by W. H. Auden. Oliver Smith designed the scenery. The theme of this ballet is the attempt by four people to rid themselves of anxiety. Despite their apparent lack of success, as pictured above, the ballet ends on a note of courage and hope. (New York City Ballet.)

leading British choreographers are Frederick Ashton and Robert Helpmann, both with the Sadler's Wells company.

Antony Tudor, an Englishman, settled in the United States in 1939. In 'Pillar of Fire' he created an intense dance drama of revolt against spinsterhood and puritanism. It is a masterpiece among modern ballets. 'Lilac Garden' is a shorter ballet, with a simpler story, but it too is a masterpiece. It portrays very movingly a farewell meeting between two lovers who are constantly interrupted by other people. Even in Tudor's more romantic ballets, such as 'Romeo and Juliet' and 'Lady of the Camellias', there is a subtlety of characterization which is absent from typically Russian ballets. Tudor's choreography combines classical ballet technique with a freer style incorporating the movements of everyday life.

Jerome Robbins, an American dancer and choreographer, created two widely different types of ballet. 'Fancy Free', an incident involving three sailors on shore leave, is completely gay and lighthearted. It successfully combines ballet technique with vaudeville routines, jitterbug, and acrobatics. 'Facsimile' and 'Age of Anxiety' are serious attempts to express the restlessness and frustrations of modern life. Leonard Bernstein composed the music for these ballets.

A number of American ballets have used typically American themes. Examples are Catherine Littlefield's 'Barn Dance', Eugene Loring's 'Billy the Kid', Agnes de Mille's 'Rodeo', and Ruth Page's 'Frankie and Johnny' and 'Billy Sunday'.

George Balanchine, Russian-American choreographer, graduated from the Soviet State School of Ballet (formerly the Imperial School) and in 1925-29 was a member of the Diaghilev company. He never felt the influence of Fokine's ideas for the reform of ballet. He came to the United States in 1933 and was afterward associated with several major American companies. He created ballets in the purest classical tradition. Most of them have little or no story but are abstractions in ballet terms of music, emotions, or ideas. Balanchine, considered by many to be the greatest modern choreographer, influenced

William Dollar, John Taras, and Todd Bolender, among American choreographers.

Fundamentals of Ballet Technique

Traditional ballet has a distinctive technique which sets it apart from all other types of stage dancing. The *turnout* is all-important. This is the turning out of the legs at an angle of 90 degrees. Because of the construction of the hip joints, it increases the range of movement of the legs. A dancer whose legs are well turned out can move freely in every direction and yet keep his face toward the audience. When he balances on one leg, he can raise

A MASSINE SYMPHONIC BALLET



Here are André Eglevsky, Igor Youskevitch, Alicia Markova, and Frederic Franklin in 'Rouge et Noir' ('Red and Black'), composed to Dmitri Shostakovich's first symphony. A feature of all Massine's symphonic ballets is the beautiful grouping of the dancers.

GREAT DANCERS ILLUSTRATE BALLET TECHNIQUE



1 Edith Allard demonstrates a perfect *grand jeté*. 2 This is Jena Workman of the Ballet Theatre. Her position is the *grande quatrième* or fourth position in the air. 3 Illustrates the adaptability of classical technique to character dancing.

the other one higher than he could otherwise. He can beat the calves of his legs together during jumps with out painful knocking together of the ankle joints.

Ballet has five positions to indicate placement of the feet when the dancer is standing still. They require the legs and feet to be completely turned out. The positions are as follows: (1) heels touching the feet form a straight line. (2) similar to the first but the heels are about 12 inches apart. (3) similar but one foot is in front of the other so that the ankles touch. (4) legs crossed the feet are parallel and a step apart the toe of one foot in line with the heel of the other. (5) feet crossed the toe of one foot touches the heel of the other.

The *articulate feet* of ballet are apparent in the pictures on this page. The term *articulate* refers to the ability of the feet to bend and point. Articulate feet help the legs always to present straight strong

unbroken lines. They add sharpness to a jump and prolong the line of an extended leg.

Erect posture with the tension in the chest and diaphragm not in the shoulders contributes the nobility of bearing essential to ballet. A good line one of the standards by which ballet dancers are judged is impossible without such posture.

Straight knees are important in most positions and during jumps. They are part of a good line. And in the leg that supports a dancer's weight a straight knee gives the spectator a feeling of security because the dancer's body appears firmly balanced.

A *demi plié* (*dě me ple-ä*) or slight bending of the knees is as important in transitions as straight knees are in positions and jumps. The *demi plié* provides impetus for the take-off in all jumped steps and absorbs the shock of landing. It makes smooth movement possible. A good *demi plié* depends to a

STARS OF THE BALLET WORLD



1 Maslone is shown in the *en-Cornered Hat* which has a Spanish folk theme. 2 Igor Youskevitch and Alexandra Danilova in *Swan Lake* exemplify classical ballet. (Ballet Russe de Monte Carlo). 3 Youskevitch and Danilova dance the *Black Swan pas de deux* from *Swan Lake*. Ballet Theatre.

great extent on the flexibility of the Achilles tendons, located just above the backs of the heels.

Vocabulary of Ballet

The vocabulary of ballet is chiefly in French, because the evolution of ballet as a system of dancing began in France. In the following definitions of the most often heard terms, the pronunciation is given if the word has not been anglicized. In the French pronunciations there is a very slight stress on the last syllable.

Applomb (ă-plôñ). Perfect balance in all movements and positions. It is essential in ballet.

Arabesque: A pose in which the dancer raises one leg, with the knee straight, directly behind the body. There are several varieties.

Ballerina (băl-êr-ê-na). A principal woman dancer in a ballet company.

Ballon (ba-lôn). Lightness and elasticity in jumps, which give a bouncing quality to movements in the air.

Corps de ballet (kôr dē ba-lā). The group dancers in a ballet, exclusive of the principal dancers. It corresponds to the chorus of a musical production.

Divertissement (dê-têr-tês-mân). An interpolated dance or series of dances having little or nothing to do with the story of the ballet; may include character dances.

'ROMEO AND JULIET'



This picture shows Hugh Laing and Nora Kaye in the title rôles of Antony Tudor's ballet. (Ballet Theatre.)

Elevation: the ability of a dancer to jump high and move in the air.

Entrechat (ăn-trê-sha): A jump in which the feet cross back and forth in the air. Nijinsky is said to have done ten, but six win applause. The number indicates the movements of each leg; there are only half as many actual crossings of the legs.

Fouetté (fûê-tâ): A turn in which a dancer, standing on one foot (usually on the point), uses the other leg in a circular whiplike motion to propel herself around, a series of 32 fouettés are a standard accomplishment of ballerinas.

Jeté (zhê-tâ or shta). A jump in which the weight is thrown onto one foot after the other is raised.

Pas (pâ). A single step or a combination of steps that forms a dance. The *pas de deux* of classical ballet has an adagio, a slow dance done by a man and woman together; variations done by the two individually; and a coda, in which the couple dance first separately and then together.

Pirouette (pir-g-êl). A complete turn on one foot, with the swing of an arm providing the impetus.

Pointes, sur les (sûr lâ pûênt). On points; that is, on the tips of the toes, as in toe dancing.

Variation: A solo dance in ballet.

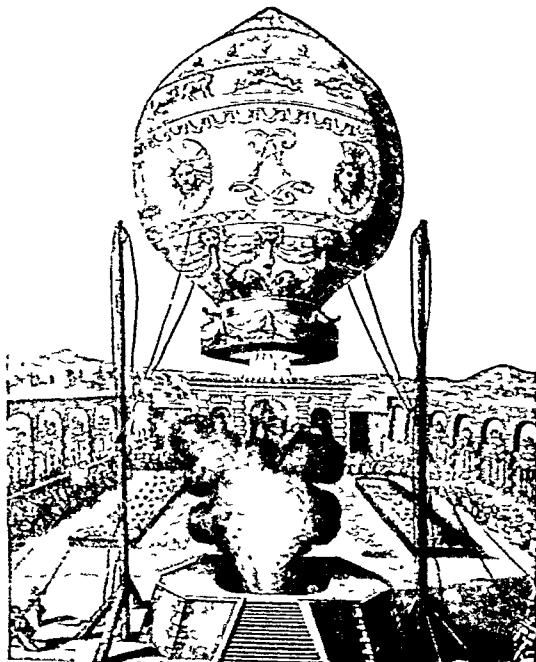
(For a discussion of training in ballet and other types of dancing, see *Dance*, opening section.)

Man's FIRST Aircraft — the BALLOON

BALLOON. All Europe was excited in June 1783 when the Montgolfier brothers of Annonay, France, sent a large paper bag sailing upward a thousand feet into the air. They had filled it with hot smoke from a straw fire. To most people of that day, the soaring bag seemed a miracle. Yet in less than 50 years inventors had worked out most of the principles and devices used in ballooning today. Within 100 years they had built dirigible balloons powered by small engines.

Why a Balloon Rises

A balloon rises because it is filled with a gas that is lighter than air. The combined weight of the gas, the balloon bag, and the load it carries must be less than the weight of the air which would occupy the same

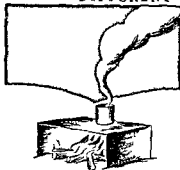


This old engraving shows the birth of air navigation at Annonay, France. The Montgolfier brothers are launching one of their first "fire" balloons, made of paper and filled with hot smoke.

space (the displaced air). Suppose, for example, that a balloon 30 feet in diameter occupies with its load about 14,300 cubic feet of space. At sea level and at standard temperature (59° F.), 14,300 cubic feet of air weigh about 1,100 pounds (see *Air*). To rise, therefore, a balloon, with everything in it or fastened to it, has to weigh less than this. So the balloon must be filled with hot air or with gases which when cool are lighter than air.

The gases most widely used are hydrogen, helium, and mixtures like coal gas that contain a lot of hydrogen. Whereas 100 cubic feet of air weigh about 8 pounds, or 128 ounces, hydrogen in the same amount weighs about 9 ounces (lifting power, 119 ounces), helium about 17½ ounces (lifting power 110½ ounces) and coal gas about 48 ounces (lifting power, 80 ounces).

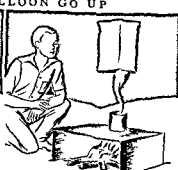
DIFFERENT WAYS TO MAKE A BALLOON GO UP



1 Hot smoke goes up



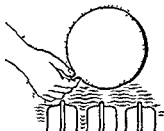
2 If you fill a light paper bag with smoke—



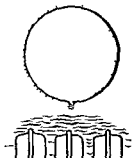
3 The bag will go up too



4 A toy balloon filled with air will not go up



5 But hold it over a hot radiator—



6 Then watch it swell and rise

Hydrogen, the lightest gas catches fire and explodes easily. The same is true of the cheaper but heavier coal gas. Helium, with 93 per cent of the lifting power of hydrogen, cannot burn. It is therefore the ideal balloon gas, but it is scarce and expensive. The only good supply is found in the United States, and its use is strictly controlled by the government (see Helium).

The toy balloon which you blow up by mouth falls to the ground because of the weight of the rubber and also because the compressed air in it is actually heavier than the surrounding air. But if you put it on a radiator so that the air in it becomes hot (not too hot or it will burst), the balloon expands and will rise and stay on the ceiling until the air in it cools off. The toy balloon soiled at circus and fairs that tugs on the end of a



7 The same balloon filled with stove gas goes up without warming

The experiment with the paper bag (1, 2 and 3) illustrates how the coal gas balloons were made. The heated toy balloon (see 4, 5 & 6) because it expands, rises without gas, as it weighs less than the air it displaces. The hot expanded balloon is lighter than the cool one (see Heat). The gas balloons (7) even when cool, are lighter than air. The gas molecules are about the same number as in the air balloon, but they are smaller and lighter molecules.

string is filled with stove gas (coal gas). If you let it go, it will rise and will not come down until it bursts or the gas leaks out of it.

In principle the round passenger balloon resembles this gas-filled toy. So long as it is fastened to the ground with a cable, it is called a captive balloon. When it is released to soar and drift with the wind, it becomes a free balloon. As we shall see, the passenger can control the up and down motion of a free balloon but not its horizontal direction.

Balloons that carry engines with propellers to drive them through the air and rudders to steer them are called dirigibles or airships. Balloons and airships are classed as lighter than air craft to distinguish

them from airplanes, gliders, and helicopters, which are heavier than air and have to keep moving or use power to stay aloft (see Airplane).

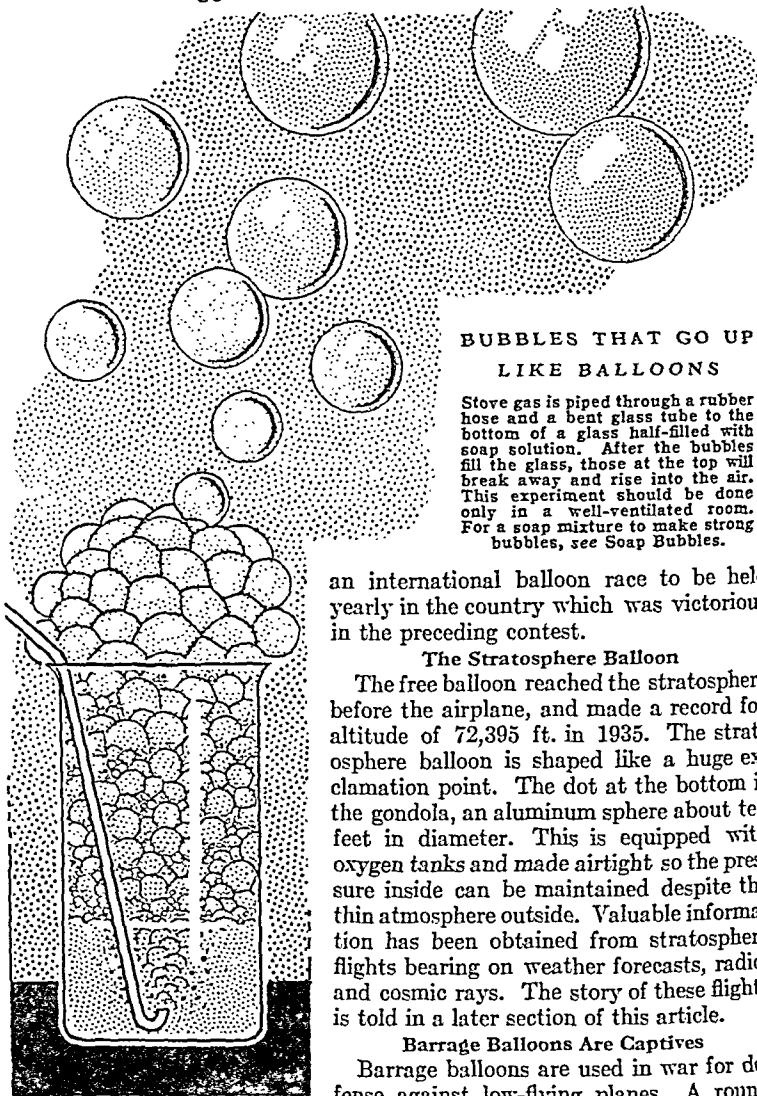
Navigating a Free Round Balloon

The free passenger balloon is nearly always spherical or pear-shaped. The huge bag is made of cloth coated with rubber or some other substance to make it leakproof. It is filled through a sleeve-like opening at the bottom, called the appendix. The entire bag is enclosed in a strong net to which the passenger basket is attached. At the top of the bag is a valve for releasing gas. This is connected with the basket by a cord that usually runs through the envelope and out the appendix. Bags of sand are hung around the basket for ballast.

When the balloonist is ready to take off, the cables are loosed, and the balloon rises gently. It is now at the mercy of the winds so far as horizontal direction is concerned. But the balloonist can gain altitude by throwing ballast overboard; or he can make the balloon drop by releasing gas. So delicate is the balance between the lifting power of the gas and the weight of balloon and ballast that a second's escape of gas or a pound of sand thrown overboard can cause a sharp change in altitude.

As the balloon rises, the lesser pressure of the upper air permits the gas to expand. The balloon tends to go higher and higher. If the expanding bag threatens to burst, the balloonist releases gas. When he wants to come down, he allows gas to escape gradually until the balloon becomes somewhat heavier than air. But as he descends into air of higher pressure, the balloon with less gas in it now contracts to smaller size than it was at the outset. It tends, therefore, to drop faster and faster. So he must now throw out ballast. When landing, or if he is being swept into danger, he can collapse the balloon quickly by opening a rip panel set into the bag's fabric.

The free balloon is not a practical means of transportation. Great distances have, however, been covered in it. One of the longest trips was made in 1914 by Hans Berliner, who sailed from Germany to a point in the Ural Mountains in Russia—a distance of 1,897 miles. In 1906 James Gordon Bennett started



BUBBLES THAT GO UP LIKE BALLOONS

Stove gas is piped through a rubber hose and a bent glass tube to the bottom of a glass half-filled with soap solution. After the bubbles fill the glass, those at the top will break away and rise into the air. This experiment should be done only in a well-ventilated room. For a soap mixture to make strong bubbles, see Soap Bubbles.

an international balloon race to be held yearly in the country which was victorious in the preceding contest.

The Stratosphere Balloon

The free balloon reached the stratosphere before the airplane, and made a record for altitude of 72,395 ft. in 1935. The stratosphere balloon is shaped like a huge exclamation point. The dot at the bottom is the gondola, an aluminum sphere about ten feet in diameter. This is equipped with oxygen tanks and made airtight so the pressure inside can be maintained despite the thin atmosphere outside. Valuable information has been obtained from stratosphere flights bearing on weather forecasts, radio, and cosmic rays. The story of these flights is told in a later section of this article.

Barrage Balloons Are Captives

Barrage balloons are used in war for defense against low-flying planes. A round captive balloon pulls and twists on its tether and may be blown to the ground. The barrage balloon therefore is shaped like a thick kite. The fins keep the balloon steady, pointing its nose upward and into the wind. A thin steel cable, fastened to a reel on a truck, holds the balloon captive. This cable is hard to see and if an attacking plane runs into it a wing may be sliced off or a propeller broken.

Limp and Rigid Dirigibles

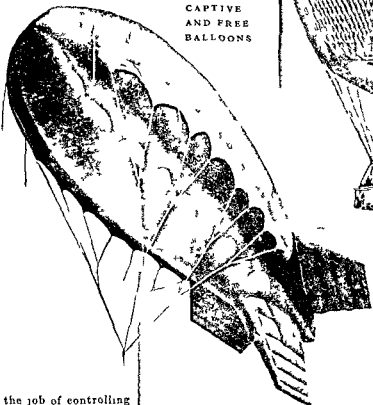
The free balloon travels with the wind. The dirigible can choose its course. The buoyant gas in its long envelope keeps the craft aloft, while engines drive the propellers that pull it through the air. The pilots operate rudders and elevators on the stern of the ship to guide its flight.

If the bag of a dirigible is limp when empty the airship is called a *nonrigid* dirigible, or more commonly a *blimp*. Blimps were used by the British in the first World War to scout for submarines and

received their name from their classification--Type B blimp. The early blimps had long cigar shaped bags which creased when gas was released and were likely to bend or buckle in storms or when turned rapidly. They could not be made large enough to carry heavy loads since any increase in the size of the bag added to the danger of folding.

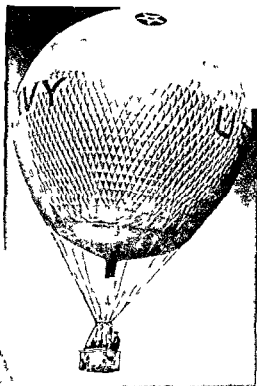
To overcome those difficulties Germany developed a rigid dirigible which was named after its inventor Count Ferdinand von Zeppelin. The Zeppelin consisted of a series of cylindrical gas bags inside a long aluminum framework. The rigid frame made it possible to construct dirigibles of tremendous size. But

CAPTIVE AND FREE BALLOONS



the job of controlling these great ships was difficult. They were easily tossed and twisted by air currents. In spite of the framework they were not able to withstand the stresses caused by violent storms. As we shall see later practically all of the great Zeppelins came to a disastrous end.

The third type of dirigible is semirigid. It has a metal keel extending the length of the ship to which the car is attached and a metal cone to stiffen the bow section. The airship used by the United States Navy in the second World War, although called blimps, belonged to this semirigid class.



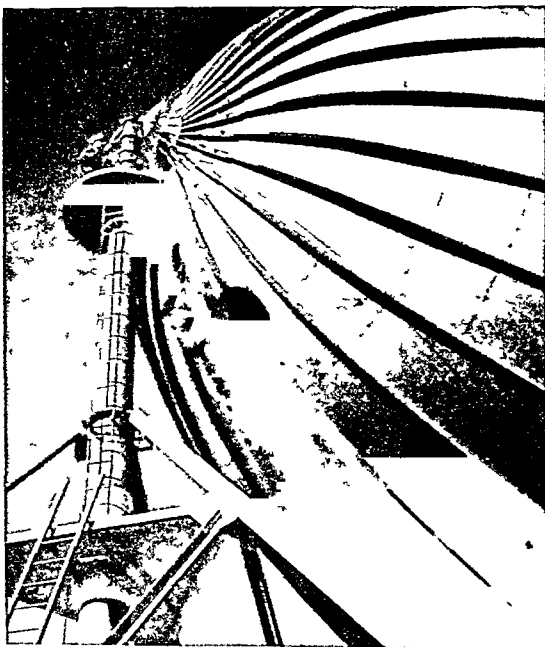
The United States Army captive balloon at the left is of the kite type. It can be used in a balloon barrage or to support an observer. A free balloon is shown at the right.

The rigid skeleton which supported the bag of a Zeppelin consisted of circular girders, cross braces and ribs which ran from end to end. It was made of a light alloy usually duralumin. The fabric was painted with aluminum to reflect the sun's rays and prevent excessive heating of the lifting gas. The gas was kept in separate cells to minimize leakage. Narrow catwalks inside the envelope permitted the crew to reach all sections. Diesel engines

were developed to burn nonexplosive Blau gas. A Zeppelin could travel 80 miles an hour in calm air.

The *Hindenburg*, the largest Zeppelin, was 804 ft long and 135 ft in its largest diameter. It could lift a total weight of about 235 tons. It carried 50 passengers and a crew of 60 besides baggage, mail and cargo. It was renowned not only for its great size but for the luxury of its two-deck passenger accommodations which were located amidships within the framework. Since hydrogen was used these quarters

HOW A BLIMP IS MADE FAST "IN PORT"



were tightly sealed off from the gas compartments in an effort to prevent fire.

Fast Naval Dirigibles

After the first World War the blimp was almost forgotten. Then it was revived by the United States Navy, improved, and streamlined to an egg shape. In the second World War this sleek craft was found to have advantages over both planes and surface vessels in scouting for submarines in United States coastal waters, out of reach of enemy planes. Searching for the periscope of a submerged submarine, planes were handicapped by their speed. A blimp could travel 80 miles an hour or slow down to keep company with a slow convoy. When it detected a submarine it could hover motionless above it and drop its depth charge with deadly accuracy. If its engines failed it could be managed as a free balloon. Round balloons were therefore used by the navy to train blimp pilots.

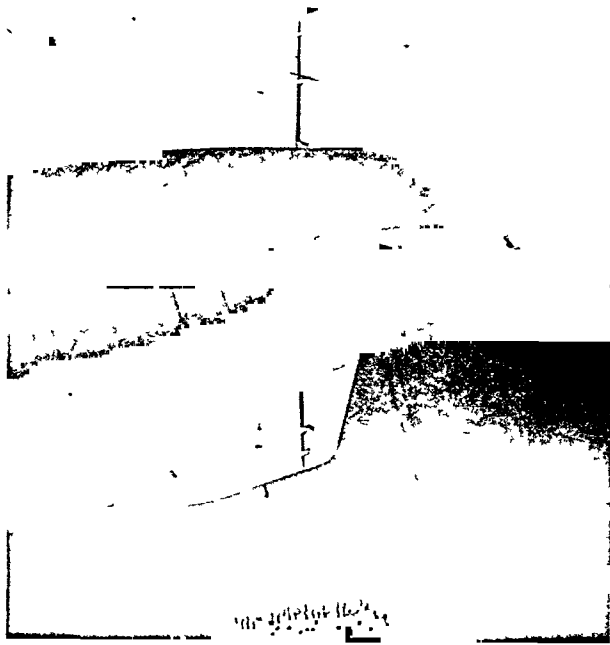
After the war the Navy continued building blimps for convoy work, coastal patrol, and antisubmarine warfare. The K-type had a capacity of 400,000 cubic feet of helium. Its eight- or nine-man crew included radio operators, riggers, and engineers. The M-type had a capacity of 650,000 cubic feet. Largest of all was the N-type, with a capacity of 875,000 cubic feet and a crew of 14.

The streamlined bag was made of three-ply rubberized fabric treated with a fireproofing substance. It was supported on a keel and the bow reinforced to prevent collapse at high speed and to provide a mooring attachment. The use of helium made it possible to build part of the car into the bag without danger of

fire. Generous window space in the lower part gave the crew a wide view of the sea. The car had room for sleeping and eating quarters, navigation and radio equipment, and a darkroom for photography. Twin air-cooled engines extended from each side of the car. From the center at the bottom hung a landing wheel on which, with the help of a ground crew, the ship could taxi to its low mooring mast.

The blimp consumed so little gasoline that it could cruise for 50 hours without refueling. If it refueled from a ship, it could stay at sea indefinitely. To refuel, two rubberized spheres, connected by a rope, were dropped to the deck of a ship. One was blown up with air. When the other had been filled with gasoline, the spheres were dropped overboard. The airman then lowered a hook, catching the connecting rope.

To take on provisions or to change crews the blimp could anchor just above the surface of the ocean. The anchor was a cone-shaped bag with a wide, open top. This filled with water when lowered into the sea,

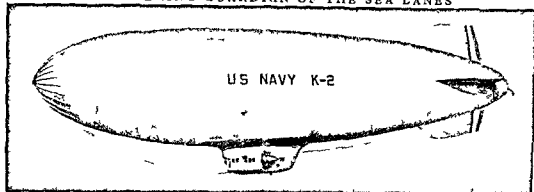


Here a United States Navy "K-type" dirigible lies secured by its nose to a mooring mast. The lower view shows the tail and controlling surfaces. Size can be judged from the men drilling below.

holding the blimp fast. It was emptied by pulling a rope attached to the bottom.

A blimp grows continually lighter as it uses up its fuel, and will rise like a free balloon unless gas is valved or ballast taken on. The Zeppelin could "blow off" the surplus gas once or twice during a trip since hydrogen is cheap and can be manufactured as needed. Helium is costly, and the navy could not afford to waste it. Furthermore, if the blimp refueled at sea, it would need a full bag of gas. So the blimp

A HOVERING GUARDIAN OF THE SEA LANES



This K type navy dirigible proved its worth in the war against submarines. Its comparatively low speed made possible a careful search of coastal waters and from the great height the crew could detect the undersize boats, even when they lay motionless on the bottom.

plot took on water ballast instead. He swung his ship down close to the water and lowered a hose. A small electric pump sucked up water to compensate for the weight of the fuel burned. If the pressure in the bag became excessive in high altitudes helium was automatically released through a safety valve.

To compute the direction and speed of the wind at different altitudes small free balloons are sent aloft. The flight is watched through a telescope and the path of the balloon is plotted to permit computations. At night a small electric lighting unit is attached to the balloon. Determination of winds aloft by this method is limited to the observer's ability to see the balloon. Some stations use radio direction finding and radar methods to observe winds above the clouds and during rainy weather.

Radiosonde was developed between 1935 and 1939 to meet the need of weather services for details on conditions in the upper air. The radiosonde consists of units that are sensitive to changes of pressure, temperature and relative humidity and a small radio transmitter with a battery. The apparatus is assembled in a small cardboard box and weighs about three and a half pounds. A balloon is inflated with helium or hydrogen to a diameter of about six feet. The balloon carries a four-foot parachute and the radiosonde. As the balloon rises the sensitive elements register changes which the radio transmits to a receiver and recorder on the ground.

The balloon expands as it rises into the upper air. On reaching a height of 50,000 to 100,000 feet it bursts and the box of instruments floats down with the para-

chute. Many of these boxes are found and mailed back to the manufacturer to be used again. For special research sounding balloons may go even higher.

Early Balloon Flights

The balloon that made the first successful public flight on June 5, 1783, was built by Etienne and Joseph

Montgolfier, sons of a rich paper manufacturer in Annonay, France. The bag, 35 feet high, was shaped of paper open at the bottom. A straw fire filled the bag with smoke and it rose to a height of 1,000 feet. The balloon, which carried no passengers, only light ballast, stayed up ten minutes. It came down when the hot air cooled.

The brothers continued to develop hot air balloons, called *montgolfières*, in their honor. It was one of these models, 72 feet high, that carried the first living passengers—a sheep, a rooster and a duck. The bag was made of waterproofed linen, gaily decorated. The ascension took place at Versailles on Sept. 19, 1783, in the presence of Louis XVI and the royal family. On October 15, in the same year, a captive balloon carried the first human being aloft, Jean Pilâtre de Rozier. He took the fire with him in a pan with straw and wool to replenish it, and when the balloon was blown against a tree he stoked the fire vigorously and so freed himself.

Five weeks later, De Rozier and the Marquis d'Arlandes soared from the ground in a free balloon. They had enough fuel to keep them aloft for 25 minutes as they drifted across Paris. Rise and fall were controlled by regulating the fire.

Hydrogen, which had been discovered in 1766, was first used in a balloon on Aug. 27, 1783, less than

GOING UP FOR WEATHER DATA



Here a sounding balloon soars aloft carrying a radiosonde to find and send down weather data. Notice the parachute that will bring the apparatus down safely.

three months after the original Montgolfier ascension. Professor J. A. C. Charles, a French physicist, sent up from Paris a bag of varnished silk 13 feet in diameter. It rose 3,000 feet and came down, as the gas leaked away, 15 miles out in the country. There the terrified peasants, believing it to be an evil spirit, fell upon it with pitchforks and tore it to pieces. In the same year Professor Charles and one of the Roberts brothers, who constructed his *charlières*, went up and stayed aloft two hours. This balloon, built by public subscription, included many of the features of today's round balloons. The cloth bag was coated with a rubber solution and a net over it supported the car. There was a valve at the top and sand ballast in the basket.

Interest in ballooning swept from country to country. In 1785 two men crossed the English Channel from Dover in a hazardous flight during which they had to throw overboard all of their equipment and even part of their clothing to keep from falling into the sea. De Rozier was killed in an attempted crossing of the Channel when his double balloon—a montgolfière attached to a *charlière*—caught fire.

Captive balloons were used for observation in the Civil War and in later European wars. Free balloons were of great assistance to besieged Paris in the Franco-Prussian War. Sixty-five balloons of the *Ballon Poste* carried 164 passengers and 20,000 pounds of mail high over the German lines. During that war the first aerial battle took place, when a German balloonist carrying a French flag suddenly unfurled his own colors and opened fire on a French craft.

Development of the Dirigible

In the meantime inventors were trying to find a way to steer balloons. Sails were tried, and feather-weight oars made of cloth stretched over a frame. In 1852 Henri Giffard installed a small steam engine in the car of a spindle-shaped balloon. The engine rotated a propeller that moved the airship five miles an hour against the wind. But steam power was both cumbersome and dangerous.

To Alberto Santos-Dumont, a wealthy Brazilian living in Paris, goes credit for developing the first successful dirigible. In 1898 he installed a gasoline engine in an airship. He built ship after ship at enormous expense seeking to win the coveted Henri Deutsch prize of 125,000 francs. And he earned this award in 1909 when he steered his cigar-shaped balloon seven miles from the suburb of St. Cloud across Paris and around the Eiffel Tower in half an hour. This feat proved to the world that the dirigible balloon was a practical kind of aircraft.

Germany, which organized for war as did no other country, at once saw military possibilities in the dirigible. Soon supremacy in air navigation passed from France to Germany, chiefly through the efforts of Count Ferdinand von Zeppelin. As a young military attaché in Washington, he had seen the usefulness of observation balloons behind the Union lines in the Civil War. He returned to Germany and devoted his life to the development of aircraft. From 1897

onward he worked on the designs which bear his name. Zeppelins were huge craft. The first had a capacity equal to the cubic content of 112 boxcars. Tested in October 1900, it made a speed of 18 miles an hour for a short distance. By 1910 the Zeppelin company was operating the first commercial airship service connecting cities several hundred miles apart. In three years it carried safely more than 14,000 passengers a total distance of 100,000 miles.

The German army used Zeppelins in bombing raids during the first World War. For a time they terrified Londoners. But the huge slow vessels proved to be easy targets for fighter planes. After the war German Zeppelins were delivered to the Allies as indemnity. Since Germany did not have enough to go around it was compelled to build one—the *Los Angeles*—for the United States.

A Grim Record of Disasters

Postwar experience started well when the British *R-34* made the first airship crossing of the Atlantic in 1919. In 1921, however, disasters commenced. The *R-34* was wrecked at its moorings and a British ship built for the United States collapsed and burned over Hull, England. In 1922 the Italian-built *Roma*, bought by the United States, exploded over Hampton Roads, Va. The next year, France's Zeppelin, renamed the *Dizmude*, was lost in the Mediterranean. In 1925 the *Shenandoah*, built in the United States, was torn in two in Ohio by a violent shift of winds.

Italy gave up dirigibles when the *Italia* crashed in 1928 while flying to the North Pole. Great Britain did the same when one of its ships exploded over France in 1930. The United States Navy built two more ships after the *Shenandoah* disaster—the *Akron*, which was destroyed by a storm off the New Jersey coast in 1933, and the *Macon*, which fell into the ocean off the California coast two years later.

Germany alone continued to build Zeppelins. In 1929 the *Graf Zeppelin* flew around the world in 12 days. The *Hindenburg*, made ten round trips between Germany and the United States in 1936, with an average time of 65 hours westbound and 52 eastbound. But in 1937 as it came to its mooring at Lakehurst, N. J., it caught fire and burned within half a minute, killing 35 of the 97 persons on board.

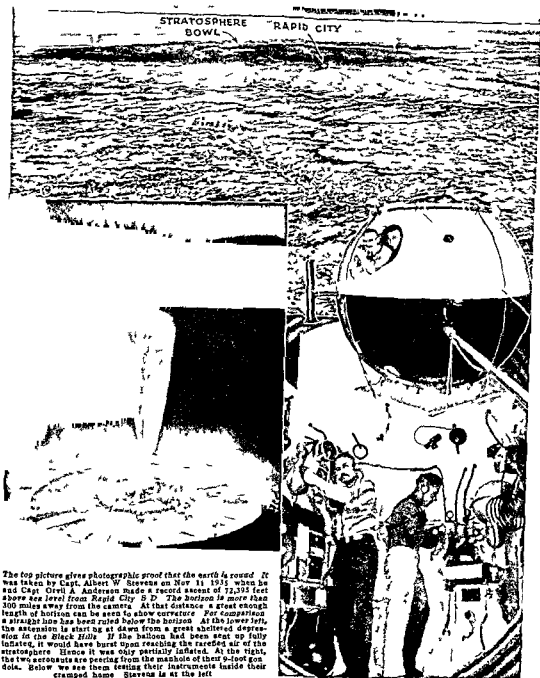
By the time the second World War began the huge rigid dirigibles had vanished from the skies.

Free Balloons Reach the Stratosphere

Much of our knowledge of upper-air conditions has been gained through the use of balloons. As early as 1784 pioneer balloonists took instruments with them to measure air pressure, temperature, and moisture at various levels, and brought back samples of air taken at different altitudes. As larger balloons were built they rose to heights where the cold was so intense and the atmosphere so thin that some passengers died. In 1898 Teisserenc de Bort, a French physicist, found that when the balloons reached a height of six to eight miles they entered a belt where the temperature no longer dropped as they rose. He named this region the *stratosphere*.

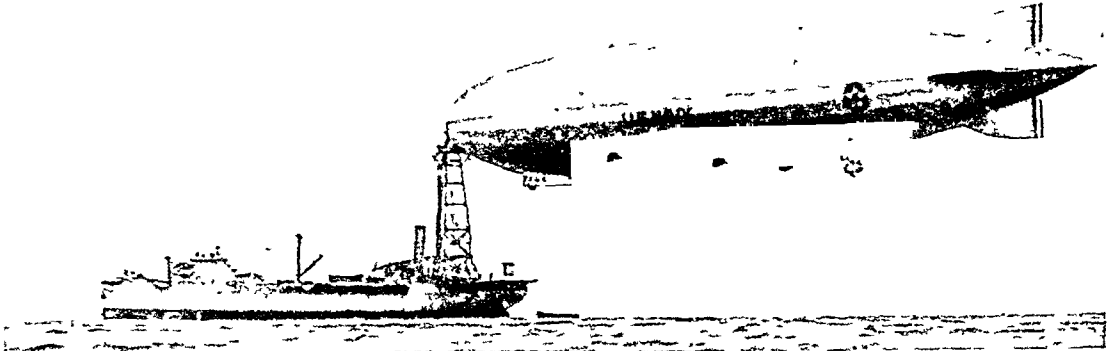
STRATOSPHERE FLIGHT SHOWS CURVE OF EARTH

—S-TACK— HILL —



The top picture gives photographic proof that the earth is round. It was taken by Capt. Albert W. Stevens on Nov. 11, 1935, when he and Capt. Orvil A. Anderson made a record ascent of 72,395 feet above sea level from Rapid City, S. D. The horizon is more than 300 miles away from the camera. At that distance a great enough length of horizon can be seen to show curvature. For comparison a straight line has been ruled below the horizon. At the lower left, the extension is started at dawn from a great sheltered depression in the Black Hills. If the balloon had been sent up fully inflated, it would have burst upon reaching the rarefied air of the stratosphere. Hence it was only partially inflated. At the right, the two aviators are peering from the manhole of their 9-foot gondola. Below we see them testing their instruments inside their cramped home. Stevens is at the left.

THE AMERICAN NAVY'S HISTORIC FIRST ZEPPELIN



This rigid dirigible, the *Los Angeles*, was built by the Zeppelin works of Germany and delivered to the United States after the first World War, as part of the reparations which were exacted from the enemy. It is shown here moored to a tender. This is the only American rigid airship which escaped disaster. It was retired from service in 1932.

Professor A. Berson and Dr. R. J. Süring rose in 1901 from Berlin to 35,440 feet. Even though they took oxygen tanks with them the men were unconscious during the highest part of their flight. Captain Hawthorne C. Gray, of the United States Army, set a record of 42,470 feet in May 1927. On a flight the following November he accidentally cut his oxygen tube and died. His instruments recorded a height of 44,000 feet.

When Prof. Auguste Piccard of Brussels University began exploring the stratosphere, he devised an airtight, ball-shaped, aluminum cabin equipped with oxygen tanks. In 1931 he rose to 51,790 feet, and in 1932 to 53,153 feet. Using similar equipment Capt. Albert W. Stevens and Capt. Orvil A. Anderson, of the United States Army, set a top mark of 72,395 feet above sea level on Nov. 11, 1935. The ascension was made from Rapid City, S. D.

These flights brought back information about cosmic rays and other phenomena within the stratosphere. By showing how men can be kept alive and comfortable at such heights they helped in the development of airplanes for stratosphere travel.

Balloons in the Second World War

Since airships are easy targets for fighter planes, the Zeppelin was not revived in the second World War. The United States Navy, however, used blimps extensively in antisubmarine hunts. Barrage balloons helped defend cities and were tied to ships to protect convoys. Small balloons protected troops in the field against strafing attacks. Japan sent thousands of free balloons, carrying incendiary and antipersonnel bombs, across the Pacific. The few that reached the United States caused little damage.

BALLOT. The purpose of the ballot is to get a faithful record of votes of citizens and yet keep secret the choice or decision of each voter. This enables all citizens to express their desires on public questions freely without having to take into account what others may think of their decision.

More than 2,300 years ago, Greek juries voted their verdicts by balls of stone or metal that hid the identity of the voter. A white ball meant "innocent;"

a black ball, "guilty." Today "to blackball" a person means to vote against admitting him to an organization.

Roman voters marked their choices on waxed wooden tablets (*tabellae*). Sometimes they were given tablets already carved with the names of the candidates. The voter dropped the tablet of his choice into an urn and gave back the other tablets to the attendant.

In the Middle Ages the feudal states tried to stamp out secret voting. But Italian republics like Venice and Florence kept alive this precious right. Their voters used little colored balls to indicate their choices, and it is from their *ballotta* ("little ball") that we get our word *ballot*.

The Story of the Ballot in America

The American colonies led the world in making "voting papers" (written ballots) the foundation of government. In 1634 the freemen of Massachusetts Bay Colony demanded the written ballot instead of the "usual raising of hands," so they could oust the unpopular Governor Winthrop. More than 150 years later the United States was to elect its first president by ballot as prescribed in its Constitution (*see* United States Constitution).

Much of the voting in those times, however, was *vive voce* (by "living voice"). The voter announced his choices at the polls, as was the custom in Great Britain until 1871. This bred vote buying, for the buyer could listen to make sure "the goods were delivered." It also made many people afraid to vote as they pleased; their employers and landlords or their spies might be listening.

These abuses doomed *vive voce* voting. After 1776, the states dropped it one by one until today every state constitution requires the ballot. The South was slowest to adopt it for state elections, Kentucky delaying until 1891.

At first, each voter prepared his own ballot. Then the candidates printed their own; and later, the political parties, each one using a different color. But the state government was not responsible for these ballots, and it was easy to counterfeit them

by printing the name of one party over the candidates of another or to slip one or two names into the column of the opposite party. Furthermore the politicians could tell from the color of the ballot what party the voter favored.

Introduction of the Australian Ballot

Then came the *Australian ballot*. It had first been adopted in 1856 by Victoria and New South Wales. Kentucky was our first state to enact it (Feb. 24, 1888) but applied it only to Louisville. Massachusetts was the first to enact it for state elections (May 30, 1888). Today it is used almost everywhere in the Union.

The Australian ballot is often called the *official ballot* because the state provides it and guarantees it to be genuine. Anyone who tampers with it is subject to severe punishment by law. Each ballot contains the names of all candidates of all parties competing and therefore keeps the voter a party preference a strict secret. Sometimes these ballots contain 500 or more names and are very large (blanket ballots). To remedy this many places have substituted the 'short ballot' by making all offices appointive rather than elective. The voters can keep control by the use of the recall (see Initiative, Referendum, and Recall).

Australian ballots vary not only in size but in makeup as well. The *party column ballot* arrays the candidates' names under the name (and sometimes the symbol too) of their political party. The voter may usually vote a straight ticket by marking a cross (X) in the party circle or he may divide his votes among two or more parties (split ticket) by marking a cross in the square next to the name of each candidate he chooses. The *Massachusetts* or *office group ballot* places together the names of all the candidates for each office, each name accompanied by the name of the nominating political party. The *Pennsylvania* or *hybrid ballot* combines the features of the party column and the Massachusetts type.

The Convenience of Absentee Voting

The right to vote while away (*absentee voting*) was first granted to Union soldiers during the Civil War and has since become an established privilege of the armed forces. Vermont in 1836 was the first state to permit absentee voting to civilians as well. It allowed certified voters to vote for state officers at any election booth in the state. Today nearly all states mail *absentee ballots* to qualified voters whose business keeps them outside their precinct county, or state on election day. Some states permit voting before leaving. Some also allow absent voting on account of disability or illness.

Machines That Record and Count Our Votes

To save time, insure an accurate count, and prevent illegal marking of ballots, many places use voting machines operated on the same principle as calculating and tabulating machines (see Calculating Machines). Voting machines were first authorized by New York State in 1892, and they were tried out in Lockport, N. Y., the same year. They first demon-

strated their speed and efficiency on a large scale in a Rochester, N. Y. city election in 1898.

A voting machine has a lever above the name of each candidate and each party. Votes are cast by pressing down on the appropriate levers. (For illustration see Elections, see also Suffrage.)

To write in a vote on a paper ballot the voter writes in the name of the candidate under the proper office, draws a square and places an 'X' in it. On a voting machine the voter opens the appropriate slot and writes in the candidate's name.

BALTIC SEA The long east arm of the North Sea is the Baltic Sea. It lies between Sweden, Denmark, Germany, Finland, Poland, and Russia. In the Middle Ages the Baltic was second only to the Mediterranean as a sea lane of Europe. But the Baltic's importance declined. Today its chief use is for local coastal shipping. Yet it is also Russia's chief outlet to the Atlantic with Soviet ships sailing from Riga, Tallinn, and Leningrad. Indeed Leningrad was built by Peter the Great in the 18th century (as St. Petersburg) to be Russia's window to the west.

The window is closed three or four months of the year by ice. This is due not only to the fact that the Baltic region has a cold winter, but also to the fact that its waters contain only about a quarter as much salt as the ocean and so freeze more readily. A fifth of the surface of Europe drains into it through more than 250 rivers among them the mighty Oder, Vistula, Neva, and Niemen. This enormous flow of river water added to the fact that there is little chance for the water from the ocean to enter the Baltic through the narrow passages connecting it with the North Sea explains why the waters of the Baltic are almost fresh. The narrow straits of the Sound, Great Belt, and Little Belt and the Kattegat and Skagerrak furnished the only outlet to the Baltic until 1895 when the German government completed the Kiel Canal across the base of the Danish Peninsula.

Even when the Baltic is open to navigation, it is dangerous to seamen because of its extreme shallowness on the German coast, the ruggedness of the Swedish coast, and the frequent violent storms accompanied by sudden changes of wind. The greatest width is about 400 miles and the length is 960 miles. As in other inland seas, the tides are scarcely perceptible. The broken coast line—about 5,000 miles in length—furnishes some good harbors, the most important being Riga, Copenhagen, Kiel, Danzig (Polish, Gdansk), and Stockholm. The northern end of the Baltic is called the Gulf of Bothnia. Its two eastern arms are the gulfs of Riga and Finland.

The Baltic was the scene of a naval battle between the Danish and English fleets on April 2, 1801, in which the British prevented the Danish fleet from falling into the hands of Napoleon. During the greater part of the first World War the German warships were imprisoned in the Baltic by the British fleet. During the second World War the Baltic shores saw bitter fighting—first between the Finns and Russians and later between the Russians and Germans.

BALTIMORE, LORDS. The North American colony of Maryland was founded and long governed by an English family. George Calvert, first Lord Baltimore (1580?-1632), planned the colony but did not live to see its formation. His sons carried on his work. They were Cecil, second Lord Baltimore (1605?-1675), and Leonard (1606-1647). The largest city in Maryland is named for the Lords Baltimore.

In their English homeland the Lords Baltimore were better known by their family name of Calvert. George Calvert was born at Kipling in Yorkshire. His family, which had a successful mercantile business, was of Flemish descent. He graduated from Oxford University in 1597, then toured Europe. On his return he became secretary to Robert Cecil, minister to James I.

From 1609 to 1625 Calvert served in Parliament. In 1612 he was made clerk of the Privy Council and in 1613 was sent to Ireland to investigate Catholic complaints. Four years later Calvert was knighted. In 1619 he became first secretary of state. His task was to defend James's unpopular policies in Parliament. In 1625 Calvert became a Catholic. He resigned his post, because Catholics were forbidden to take the oath of supremacy to the English crown. But James rewarded his past service by making him first Baron of Baltimore in the Irish county of Longford and gave him large Irish estates.

Lord Baltimore spent the rest of his life in colonizing activities. He had already been a member of the Virginia and New England companies, and in 1620 he had bought land in Newfoundland. He called his land Avalon. James granted it to him as a palatinate. This meant that Calvert held feudal power and was subject only to the king. In 1621 and 1622 Calvert sent two companies of settlers to Avalon and in 1627 inspected it briefly. He returned in 1628 with his family and hoped to establish Avalon as a haven for English Catholics. But a winter in the barren, rocky country discouraged him, and the next spring the Calvert family sailed to Virginia.

Here Calvert met opposition. The Virginians feared his influence with the king and disliked him as a Catholic. He returned to England

and petitioned for a grant of land in the colony. He died in 1632, and the grant for the palatinate of Maryland was given to his son Cecil, who became the second Lord Baltimore.

An Oxford graduate, Cecil had married the daughter of the Earl of Arundel, a powerful Catholic noble. Cecil stayed in England to advertise for colonists and to protect the interests of the new colony. In

1633 his younger brother, Leonard, sailed to Maryland as governor, accompanied by more than 200 colonists (*see Maryland*). Despite his youth, Leonard was an excellent leader. His tolerance, sound judgment, and willingness to compromise gave stability to the colony. He also faithfully put into practice Lord Baltimore's ideal of freedom of worship in Maryland. This policy was made law in 1649 in the 'Act Concerning Religion'.

Leonard Calvert returned to England in 1643 and stayed about a year. Shortly after his return, the old dispute with the Virginians flared again. Rebellious Protestants took possession of Mary-

land, and Leonard Calvert sought refuge in Virginia. He regained Maryland but died soon after, in 1647.

With Parliament in power, Lord Baltimore had to appoint as governor William Stone, a Parliament favorite. But Lord Baltimore could not keep out of the struggle in England. His estates were fined, and from 1654 to 1658, Parliament took over Maryland. It named as governor Josias Fendall who led a rebellion against Lord Baltimore.

When this was put down, Phillip Calvert, another brother, governed briefly. After the restoration of Charles II, Lord Baltimore named his son Charles as governor in 1661.

In the 1660's Lord Baltimore extended toleration beyond the letter of the law. A Jew was accepted as a citizen, and Maryland attracted many Quakers. Maryland was also the first colony to naturalize foreign citizens.

Charles Calvert took over the proprietorship of the colony as the third Lord Baltimore in 1675 when his father died. In little more than 40 years, the Calverts had made a refuge for Catholics, had planted a colony that grew from less than 300 to 20,000 inhabitants, and had brought toleration to the New World.

FIRST LORD BALTIMORE

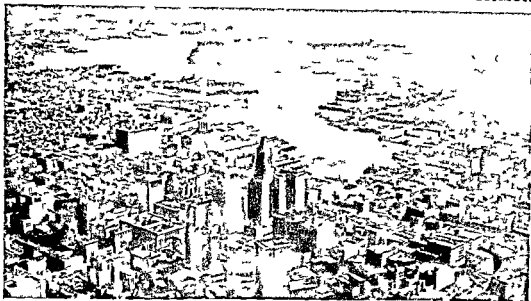


Sir George Calvert planned a haven in the New World.

CECIL CALVERT, SECOND LORD BALTIMORE



Cecil Calvert realized his father's dream and made Maryland a colony where all could worship as they pleased.



Baltimore is Maryland's greatest city and a major port of the world. This fourth air view shows the downtown business district and the estuary of the Patapsco River.

Historic BALTIMORE—A Thriving PORT CITY

BALTIMORE Md. Few cities have the charm and historic interest of Baltimore. Here the bustle of a modern city blends with the stately mementos of a colorful past. And here the hurried pace of the North meets the more leisurely way of the South.

Along the northwest branch of the Patapsco River is a busy area of factories, warehouses, railroads and docks. Here it is easy to realize that this is the nation's sixth largest city and one of its leading ports and industrial centers. A few blocks north, in the calm dignity of Mount Vernon Place, one becomes aware of Baltimore's historic past and its deeply rooted ties to the old South.

Advantages of Location

Baltimore lies near the head of Chesapeake Bay along the estuary of the Patapsco River. It is on the fall line where the rivers tumble down the rocky edge of the Piedmont Plateau to the flat Coastal Plain. Many cities grew up along this line where they had water power and a point on at the head of navigation. In due time they were connected by highways and railroads and many of these passed through Baltimore for it lay midway between north and south. Thus the city became a commercial center.

As settlements sprang up in the west, Baltimore's businessmen were quick to forge links with them. They promoted federal construction of the Cumberland Road (or National Pike) westward from Cumberland Md. When New York completed the Erie Canal in 1825 and threatened to draw all the western trade, they built the Baltimore and Ohio Railroad across the mountains. Today the city is served by railroads, federal highways, airlines and a number of ocean shipping

lines. The modern Friendship International Airport opened in 1950 provides excellent air travel facilities.

Baltimore is somewhat far from the sea—10 miles and the extension of Chesapeake Bay adds to the length of voyages to and from northern ports. To offset this disadvantage the Chesapeake and Delaware Canal was completed in 1829 across the upper peninsula separating the Chesapeake and Delaware bays. The federal government purchased the canal in 1910 and later made it a sea level waterway accommodating all but the largest ships. The canal shortens distances to all northern ports. For a ten knot vessel it cuts sailing time to Philadelphia by 27 hours, to New York 13 hours and to Europe 10 hours.

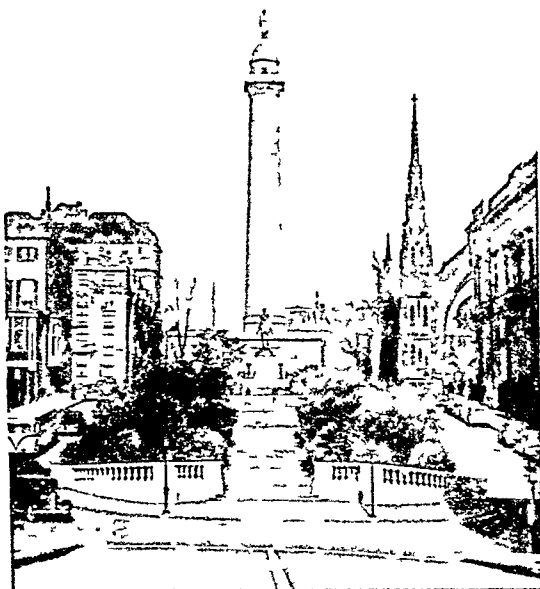
The Port of Baltimore

The best view of the harbor is from Federal Hill, now a city park. In the days of the famous Baltimore clipper ships, signals from the hill told merchants their ships were entering the river. The harbor is now used by many freighters. They bring in iron, manganese and copper ores, molasses and raw sugar, coffee and petroleum. They carry out iron, steel and other metal products and coal, grain, flour and chemicals. Baltimore is the third largest Atlantic port in the nation.

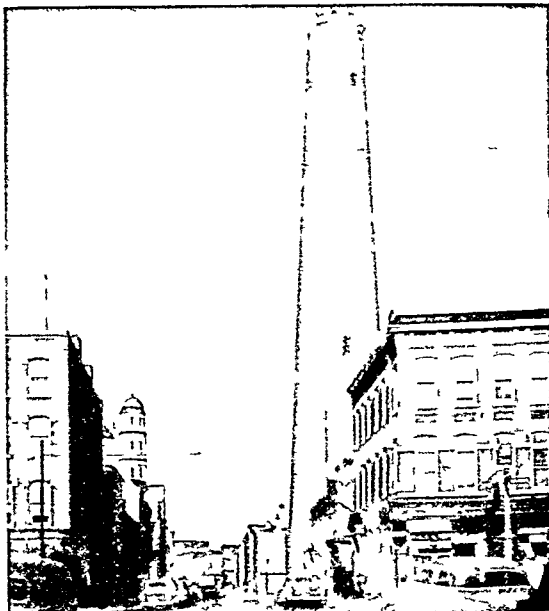
The Industrial City

Baltimore was a manufacturing center almost from the first. A copper rolling mill was in operation here in the early 1800s. In the late 1810s some Welsh workmen were brought in to smelt copper ores. Baltimore copper soon became noted for its uniform quality. For many years the city was the world's greatest maker of copper products. Today Baltimore

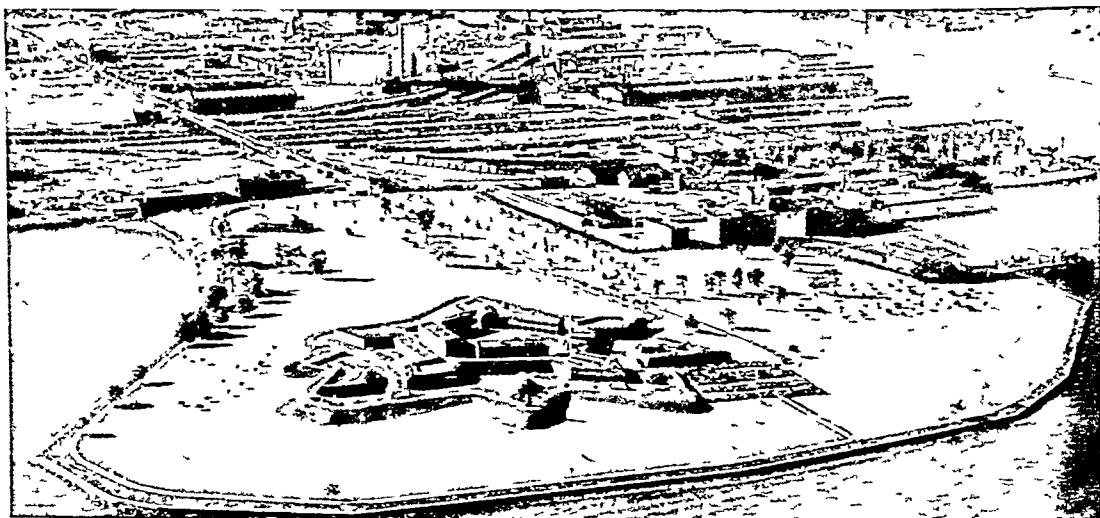
BALTIMORE—THE CITY OF MONUMENTS



In Baltimore is one of America's first memorials to George Washington. About 200 feet high, its cornerstone was laid in 1815.



The Shot Tower, built in 1828, is 234 feet high. It was used to make shot by dropping hot lead from its top into a pool of water.



Baltimore harbor is the birthplace of 'The Star Spangled Banner'. The courageous defense of Fort M'Henry against the British

in 1814 inspired Francis Scott Key to pen the national anthem. The historic fort is preserved as a national monument.

leading manufactured products are iron and steel, aircraft and parts, and radio and television sets. The building and repair of ships is also important. The Bethlehem steel mills at Sparrows Point are among the largest in the world. The Glenn L. Martin plant produces giant commercial and military planes.

Other factories turn out metal stampings and tin cans. The latter go to the many Maryland plants which pack vegetables, fruits, and sea food. The city also produces metalworking and other machinery; automobiles and equipment; heating apparatus and

plumbing supplies; bottles and paper boxes; bakery goods, packed meat, and sugar; men's and boys' suits, overcoats, and work clothes and women's outerwear; chemicals, refined petroleum products, smelted copper, and copper and brass goods.

The Historic City

The settlement that occupied 60 acres in 1729 has grown to cover 92 square miles. Marshes have been drained, hills leveled, and valleys filled in. Many wooded streams and hills still remain, however, to add their natural beauty to the parks and suburbs.

In the old part of the city near the river are some of the original narrow, crooked streets. Here are old houses with fine doorways and iron work. Long lines of identical "row houses" with gleaming white marble steps are characteristic. Westminster Church yard, where Edgar Allan Poe is buried, is in this part of the city. Here too is the Cathedral of the Assumption of the Blessed Virgin Mary. It was the first Roman Catholic cathedral built in the United States. In 1937 Pope Pius XI gave it the rank of minor basilica, because of its historic importance. In its crypt is buried James Cardinal Gibbons, church leader and statesman. He was one of Baltimore's most notable residents.

North of the main business district

quiet Mount Vernon Place on Monument Street and Washington Place on Charles Street form a cross radiating from the base of the Washington Monument. The area is popularly known only as Mount Vernon Place. Century-old residences overlook the square, its trees, shrubs, fountains, statues, and the famous memorial to George Washington.

Because of the many fine memorials in different parts of the community, some believe, Baltimore is called the 'Monumental City'. The oldest existing memorial is the Columbus Monument, dedicated in 1792 and the first to honor him in the New World. It is an obelisk built of English brick.

In the Civic Center on Fayette Street is the Battle Monument. It commemorates the Baltimore militia who repulsed British attacks during the War of 1812. Near by, in Memorial Plaza, is the World War Memorial. To the east is the 234-foot shot tower, built in 1828 to make lead shot.

The Civic Center is also the site of a group of public buildings. These include the white marble courthouse, containing mural decorations by the artists Blashfield, Turner, and La Farge, the City Hall, and the municipal and post office buildings.

Great Educational Institutions

North of Mount Vernon Place is Johns Hopkins University. An influential educational institution, it was endowed by Johns Hopkins, wealthy Quaker banker and merchant. It opened in 1876 with an eminent staff that included Daniel Coit Gilman as first president, Ira Remsen, professor of chemistry, and Henry A. Rowland, professor of physics. The poet Sidney Lanier was a lecturer in English literature from 1879 until his death in 1881. The Medical School has made many contributions to medicine and surgery under the leadership of such men as Sir William Osler

and William Henry Welch. The school with its many hospitals and clinics is on and near Monument Street, some distance east of Mount Vernon Place.

Baltimore is also the home of Goucher College for women, Peabody Institute and Conservatory of Music, the University of Maryland's schools of medicine, pharmacy, and law, Baltimore College of Dental Surgery, the first dental school in the world and now part of Maryland University and Maryland Institute (an art school). The Walters Art Gallery, Baltimore Museum of Art, Municipal Museum and Maryland Historical Society have notable collections. Enoch Pratt Free Library is among the nation's largest.

The City's History

Baltimore started as a port to serve

the growing settlements and farms along the banks of the upper Patapsco River and inland from there. In 1729 a town was laid out on the west side of Jones Falls. It was named for the Lords Baltimore who founded the Maryland colony nearly 100 years earlier. In 1745 it united with an older settlement near by.

During the Revolutionary War the British blockade of the rival port of Annapolis helped to divert trade to Baltimore. The city equipped many private armed vessels to prey on British shipping. For several weeks (Dec. 20, 1776-Feb. 27, 1777) the Second Continental Congress met here.

In the War of 1812 Baltimore privateers were again active. They burned, sank, or captured 556 British ships, ten times as many as the American privateers. Lost England called the city a nest of pirates and bombarded it unsuccessfully on Sept. 13, 1814—all day and through the night. The sight of the American flag still flying over Fort McHenry the next morning inspired Francis Scott Key to write "The Star Spangled Banner" (see National Songs). The house of Mrs. Mary Pickersgill who made this flag is preserved as a memorial. Fort McHenry is now a national monument. The original manuscript of the song is in the Walters Art Gallery.

The first blood of the Civil War was shed when a Baltimore mob attacked the Sixth Massachusetts Regiment as it passed through the city on its way to Washington, April 19, 1861. Although Maryland did not secede, its loyalties were divided. During the entire war Union troops were stationed in Baltimore. Here in 1864, Abraham Lincoln was renominated for the presidency. On Feb. 7-8, 1904, a great fire destroyed more than 1,000 buildings in the business section. After rebuilding the city prospered. Population (1950 census) 949,708.

THE CARROLL HOME ON JOHNS HOPKINS CAMPUS



About 1891 Charles Carroll began this mansion, known as Homewood. He was a signer of the Declaration of Independence. The home is a perfectly preserved example of Georgian architecture. It belongs to Johns Hopkins University.

BALZAC (*bāl' zăk*), HONORÉ DE (1799–1850). For his theme as a novelist, Balzac chose the vast panorama of French life in his own time. He called his series of more than 90 novels 'La Comédie Humaine'

HONORÉ DE BALZAC



Balzac wrote penetrating studies of French life.

(The Human Comedy). The title was in deliberate contrast to the Italian poet Dante's 'Divine Comedy'. For Balzac treated the earthly activities of men in realistic detail; he showed the different levels of society and how men acted in private and public life. 'The Human Comedy' is an accurate social history of France during

the first half of the 19th century. It is also a penetrating study of human behavior.

Balzac was one of the hardest working men who ever lived. Writing the manuscript was only the first step in his labors. He would revise the printer's proof until there was little left of the original text, then repeat this procedure through as many as 16 successive proofs of the same page. His typical working day began at midnight and ended at five o'clock in the afternoon. He drove himself with cup after cup of strong black coffee. Only the most powerful body could stand such strain. Balzac had the good health of his peasant ancestors, with a thick, short frame and a fat, ruddy-cheeked face.

Balzac was born in Tours, France, on May 20, 1799. His father, a peasant's son, had risen to become a banker and a supplier to Napoleon's army. His mother came from a lower middle-class family. Honoré was an unwanted child. In infancy he lived at his nurse's home. When he was four, he was boarded out with strangers, coming home only on Sundays. When he was seven, he was sent to boarding school at Vendôme for six years. He was a poor student, neglected by his parents and misunderstood by his teachers.

After another boarding school, he attended the University of Paris for a time, then was apprenticed to a notary. When he was 20 Balzac finally asserted himself. He begged his parents to support him for two years while he prepared to be a writer. In a tiny Paris garret, Balzac wrote several high-sounding but amateurish pieces which interested no one. The two years were nearly up when Balzac and a partner began to turn out cheap blood-and-thunder romances.

For eight years Balzac did not write under his own name. He earned much money, but lost most of it in rash business ventures. In 1829 he wrote 'Les Chouans' (The Insurgents), the first volume of 'The Human Comedy'. He spent more recklessly on houses, furniture, decorations, and new business ventures. He worked even harder to support this magnificent living.

In 1832 a Polish noblewoman, Eve de Hanska, wrote him a letter praising his work. They met the next year and Balzac fell in love with her. They continued to meet and write for several years. Her husband died in 1841; but she put off marrying Balzac until 1850. Only six months later Balzac was dead, worn out by his gigantic labors. He died Aug. 18, 1850, in Paris.

Balzac's chief works are: 'La Peau de chagrin' (The Wild Ass's Skin), 1829; 'Le Curé de Tours' (The Priest of Tours), 1832; 'Eugénie Grandet' (1833); 'Le Lis dans la vallée' (The Lily of the Valley), 1835; 'Le Père Goriot' (Old Goriot), 1835; 'César Birotteau' (1837); 'Ursule Mirouet' (1841); 'Le Cousin Pons' (Cousin Pons), 1846; 'La Cousine Bette' (Cousin Betty), 1847.

BAMBOO. The tall treelike grass called bamboo is one of the most widespread and valuable plants in the world. Nearly 500 species grow in Asia; in South, Central, and North America; and in Africa. Although bamboo is a tropical plant, it will grow in temperate zones. Asiatic varieties have been imported for cultivation in the United States and Europe. Bamboo is one of the most generous plants in nature. A single root may produce as many as 100 polished jointed stems rising 30, 50, or even 120

BAMBOO IS THE KING OF GRASSES



This bamboo grove in Jamaica, British West Indies, forms an arched canopy over a country road.

feet. Branches are numerous toward the top. Flowers and seeds are produced yearly by some kinds, while others bloom only once in 50 or 100 years. The bamboo stem is sometimes three feet around. Young sprouts grow fast, at times a foot or more daily.

Bamboo products range from food to houses. Oriental cooks serve peeled young sprouts as we serve asparagus. They also candy and pickle them and add them to many dishes. Americans import the canned sprouts for use in chop suey. The hollow stems are used for water pipes and for building bridges and houses. Short sections for poles and cooking utensils. Split into strips, the stems form planks for walls, floors and roofs. The inner strips are woven into mats, chairs, beds, cages and porch curtains. So-called split bamboo fishing rods are made of selected and matched strips carefully tapered and glued together. Small products of split bamboo are chopsticks, hairpins and fan ribs. From the inner parts of the stem, quality papers are manufactured.

Bamboos belong to the family Gramineae (see Grasses). Only two bamboos are native to the United States. The giant cane (*Arundinaria gigantea*) of the canebrakes from Virginia to Florida and *Loosiana* grows about 25 feet tall. The switch cane (*Arundinaria levis*) that grows from Maryland and Indiana south to Texas rarely exceeds 12 feet. *Bambusa Arundinacea* of India and *Phyllostachys edulis* of China may grow more than 100 feet tall.

BANANA From the rootstock of a dead banana plant, a single green leaf shoves through the loose dank soil and up into the light. So tender a thing and yet within a little more than a year it will have become a full-grown banana tree towering from 15 to 30 feet high with a trunk from 8 to 16 inches thick. Flouncing out palm fashion there will be from 8 to 20 leaves that may measure 12 feet in length and more than two feet in width. And its fruit will be ready for harvesting—from 60 to 180 full-grown bananas weighing from 50 to 150 pounds.

Actually the banana plant is not a tree at all. It is an herb—the largest on earth—composed of overlapping leaves sheath on sheath like celery stalks. The leaves wrapped tightly about each other give the appearance of a tree trunk, but the plant is 80 per cent water. A 30-mile wind may break it down. A little dry weather, or insufficient drainage will kill it. And the stalk is so soft one can hack through it with a bread knife.

Before the leaf rises into the tropical daylight, other things have happened down in the earth. Out of the rootstock emerged pencil-thick roots to spread out for at least 15 feet and down to a depth of three or four feet. These pipe lines carry water and minerals to the ambitious sprouts above the ground.



HOW BANANAS DEVELOP

The top picture shows blossoms turning into bananas. These blossoms grow between the overlapping sheaths of bracts of the banana-shaped flower bud at the tip of the stem. From inside this bud, layer after layer of the finger-like blossoms comes to spread out. The bracts soon fall off and the tiny bananas turn upward. The next picture shows three layers or hands of bananas formed in this manner. In the bottom picture all the blossoms have emerged from the flower bud and mature into full-grown bananas tightly clustered around the stem.

New leaves form constantly, pressing up into the center of the plant, forcing the old ones outward, and enlarging the stalk. The large bright green leaves which extend from the top of the stalk draw up the exact amount of moisture essential to the plant's maximum growth. When the tropical sun blazes down fiercely, the leaves shrivel; the pores contract and the plant is guarded against too rapid evaporation. In wet or comparatively cool weather, the leaf-edges spread and curl upward, thus allowing increased evaporation.

Ten months after sprouting, an amazing thing happens. For some time the stem which is to bear the bananas has been rising from the roots up through the center of the stalk, and now it appears as a flower-bud at the crown or top of the stalk. The stem lengthens, the flower increases in size, bends over, and hangs downward. Soon the petals of this flower drop off, and inside is seen a bunch of tiny bananas pointing toward the earth. As the bananas grow larger, however, they turn upward. From three to four months elapse from the time the flower appears until the bananas are ready for cutting. The bananas grow around the stem in layers or "hands." There are from 14 to 20 "fingers" (bananas) to a hand, and from 6 to 9 hands to a "stem" (bunch).

The plant produces only one bunch of bananas in its lifetime. Then it decays, to become soil from which will spring new vegetation. Only the rootstock remains, from which will sprout another tiny leaf. And so the cycle is completed.

Grows Throughout the Tropics

The banana's original home is southern Asia, but it will grow in almost any hot and moist climate.

HOW THE BANANAS LEAVE THE JUNGLE



Above, banana pickers on a plantation in Guatemala are loading a mule-drawn tram which will carry the fruit to the railroad. At the left, we see an overseer directing the transfer of the fruit to the cars that will deliver the cargo to a waiting banana boat on the seacoast.



Today it is widespread throughout the tropics. Eaten cooked or raw, it is a mainstay of the diet in many tropical areas. Commercial production of bananas for export is especially important in Mexico, Central America, Ecuador, Colombia, Brazil, Jamaica, Cuba, and Haiti.

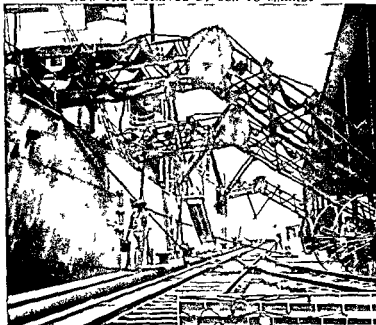
Spanish missionaries introduced the banana into tropical America early in the 16th century. The first bananas to reach the United States came to New York from Cuba in 1804. Not until the middle of the 19th century, however, did shipments begin to arrive with any degree of regularity. Even then, and for many years thereafter, they were a novelty, and were often sold one at a

time in tin-foil wrappings. Today bananas are almost as common as apples in all parts of the country.

The Banana Plantation

The modern banana plantation is a striking example of intensive farming. The labor is done by natives under trained overseers. About 30 per cent of the plantations are native owned, while 70 per cent are owned by foreign companies, such as the United Fruit

HOW THEY TRAVEL BY SEA TO MARKET



In the hammock like conveyor belts of loading machines like the one shown above bananas are put aboard ship without loss of time or injury to the fruit. The picture at the right gives you a glimpse of a section of one of New York City's ripening rooms.

Company To establish new plantations there must be considerable exploration and investigation to determine whether conditions are favorable. There must be hot days and humid nights. There must be considerable rainfall—80 to 200 inches. Drainage must be adequate, and a shipping port must be available. Risk from floods and hurricanes is also looked into, as well as the labor supply.

After the site is chosen comes the tremendous task of carving a plantation out of the jungle—from 500 to 1,000 acres. Modern machinery rips and tears and cuts out the underbrush. The big forest trees are left standing temporarily. Swamps are drained. Perhaps a harbor will be created on the nearest coast with wharves to accommodate ocean going vessels. Towns are laid out, hospitals and schools established.

Holes are staked out in the newly-cleared land—usually 18 to 24 feet apart. In each hole is planted a length of rootstock weighing three to four pounds and having at least one good 'eye.' After the planting the trees that were left standing are felled. In the

tropical heat and moisture, they soon decay into fertilizer. Three months later the plants are well up, but so is the unwelcome jungle growth. Again the land is cleared of vines and underbrush.

Harvesting and Shipping the Fruit

At last when the bananas are ready for harvesting the plants are cut down. The fruit is usually cut while still green, whether it is to be exported or used locally. Most varieties of bananas lose their flavor and may split their skins if they are allowed to remain on the plant until they are ripe.

The bunches of bananas are placed in canvas sacks on the backs of mules and hauled to trams then pulled by mules to the wharves. When the distance between plantation and harbor is great a narrow gauge railroad may be built to haul the fruit. The waiting ship is filled by means of automatic loaders then quickly steams away. In as little as 12 hours 85,000 bunches can be loaded into these specially built boats which are equipped to keep the fruit at an even temperature.

The ship is unloaded at its destination usually by pocket elevators and conveyor belts. The bananas are trucked to local ripening rooms or loaded aboard fast trains. Since bananas arrive all through the year, both ice and heated freight cars



are employed. In commercial ripening rooms the temperature is kept at 64°, and the fruit is usually ready to eat in a week. The same treatment is given to bananas which travel the whole distance by rail, as is the case of those arriving from Mexico.

Value as Food and Fiber

The banana contains almost all necessary elements for a balanced diet. It is a valuable source of vitamins

A, B, C, and G. Though a banana is about 75 per cent water, it contains alkali-forming minerals, natural sugars, protein, ash, and little fat. When ripe, a banana is easily digested and gives quick energy.

The broad leaves of some varieties are torn into strips and woven into mats and coarse cloth. Natives use the fiber of the plant for twine.

Familiar and Strange Varieties

There are many kinds of bananas. Most of those we buy in the United States are of the variety Gros Michel, or Big Mike (*Musa sapientum*). This comes from Jamaica and Central America. When fully ripe, its skin is yellow with brown flecks. Bananas still tipped with green are best for cooking. To prevent sliced bananas from darkening, sprinkle the slices with the juice of grapefruit, orange, or lemon.

Another import is the Canary Island banana (*Musa cavendishii*), also called the dwarf Chinese banana. It is smaller than the Gros Michel. Its immunity to a soil disease makes it valuable to planters in some parts of Central and South America. It is also grown in gardens in warm regions from Florida to California.

Many delicate varieties are rarely exported because they bruise easily. Among them is the Ladyfinger, a banana about three or four inches long, grown in the Canary Islands. Another is the Mensaria Rumph

from the Malay Archipelago. It has a delicate fragrance like rose water. Other prized varieties are the Lacatan, a very sweet greenish-yellow banana of the Philippines, and the Champa of India. The red Jamaica banana is grown in various parts of the world. It is also hard to ship because the fruit does not cling to the stem. Some shippers now encase bananas in plastic bags to prevent bruising and fruit loss.

"Figs," Flour, and Plantains

In tropical countries banana "figs" are popular sweetmeats. They are ripe bananas, preserved by sun-drying and sprinkled with sugar. Unripe bananas, which have a high starch content, are dried and ground to make banana flour. It has long been used in the tropics and now appears in the United States in special diets and in some baby formulas. The flower clusters of some banana plants are considered a delicacy in India. They are usually cooked in curries.

One species of banana, the plantains (*Musa paradisiaca*), are one of the chief foods of natives in the tropics. Plantains take the place of our bread and potatoes. They are "cooking bananas" and are seldom eaten raw. The fruit of one kind of plantain grows to enormous size, sometimes two feet long and as thick as a man's arm. (For pictures of bananas and their flower in color, see Fruits.)

STRIKE UP the BAND—"The Finest in the Land"

BAND. "Here comes the band!" Splendid, bold music soars up the avenue, and a tingle of excitement stirs the crowd. As the marching rhythm sweeps nearer, hearts beat a little faster and eyes sparkle. This is the zestful music loved by people everywhere.

Band music is rooted far back in man's love of rhythm. From earliest days men patted out "tunes" on hollow logs or pieces of hide stretched taut and rhythmically blew whistles made of bits of bone or stone. Today primitive peoples still beat rhythm from such crude instruments as gourds; and some of this music is as deft and intricate as that played on the most modern band instruments (see Music).

Bands in Our Nation Today

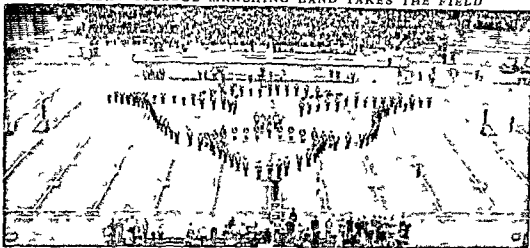
Every part of our country has its band. It may be a school or college band or one formed by the American Legion, the police, an armed service unit, park district, municipality, store or factory, youth organization, or a lodge such as the Elks or Shriners.

By 1954 there were more than 35,000 high-school bands, made up of some 3,000,000 boys and girls. They work faithfully at their rehearsals and private practice, giving up hours of their free time. They find it worth their effort. "Making music" is pleasure in itself, but playing in a band brings other rewards too. Nearly everyone enjoys being a member of a team, and band playing is teamwork. Every player, of course, also takes pride in his gleaming instrument and smart uniform. The band, moreover, is a feature at school events and, in some communities, in civic celebrations. The boys and girls in the band not only know that their music gives pleasure to their



A gaily smiling, high-stepping drum majorette adds sparkle to the marching band. Usually she specializes in baton twirling while a drum major does the actual work of guiding the band.

A GREAT COLLEGE MARCHING BAND TAKES THE FIELD



Every well trained college band practices as many skilled formations as the football team. Here the University of Pitts-

burgh band plays between the halves. Notice the four band conductors on raised wheeled stands. Each conducts in turn.

neighbors but also that they are being good citizens—taking active part in the community.

Every year high-school bands have an opportunity to enter the national Competition Festival. This is an outgrowth of a national competition sponsored by band instrument manufacturers in 1923 and later in 1926 taken over by educational music supervisors. The event has become so popular that school bands today must first play through regional tests to qualify for the national festival.

In the festival the bands do not compete against each other. They are rated on the basis of a standard of performance set by a group of judges.

The growing interest in school bands has led to establishing several band camps where students combine the fun of outdoor life with musical study. The

best known perhaps is the National Music Camp affiliated with the University of Michigan at Interlochen, Mich. More than 1,500 especially talented high school and college musicians and students of other arts gather there every summer.

What Makes a Band?

The two principal types of band are the *marching band* and the *concert band*. The marching band plays only instruments which the musicians can carry as they walk, and so they are usually limited to wind and percussion instruments. The *wood-wind* instruments most common in marching bands are the flute, piccolo, oboe, clarinet, and bassoon. The popular *brass winds* include the cornet, trumpet, trombone, sousaphone, saxophone, and various saxhorns. The chief *percussion* instruments are the drum, cymbals, and

THE "MARCH KING" AND UNITED STATES MARINE CONCERT BAND



At left is John Philip Sousa, the most famous of all American bandmasters and band composers. He wrote the "Stars and



"Stripes Forever." At right is the Marine band which Sousa, in 1880 to 1892, developed into the finest band in the land.

SPECIAL MILITARY BANDS ABROAD AND HERE AT HOME



The skirl of bagpipes shrills through the streets of Edinburgh as the Scottish pipers lead the regiment to church services. Canada also has celebrated bands of bagpipers.



American Legion posts are proud of their drum and bugle corps. Here a precision-drilled corps forms on a rain-soaked street. Proud, disciplined bands of all kinds must ignore bad weather.

triangle. Some marching bands also carry the glockenspiel and bell lyra. (See also Drum; Horn, Musical; Wood-Wind Instruments.)

Concert bands play while seated or in stationary formation and so use a larger variety of instruments. In addition to those played by marching bands, concert bands also use such instruments as the cello, string bass, tympani, harp, chimes, xylophone, and vibraphone. (For pictures of all instruments mentioned for both bands, see Musical Instruments.)

Today there are very few "brass bands"—groups which use only brass instruments. Their lively but strident tootlings and blaers are usually heard only in theatrical novelties. Dance bands or dance "orks" (orchestras) use many of the instruments played by concert bands and usually add a piano. "Hillbilly," "Western," and "country" bands often feature the harmonica, violin, guitar, or zither.

The Drum Major and Baton Twirling

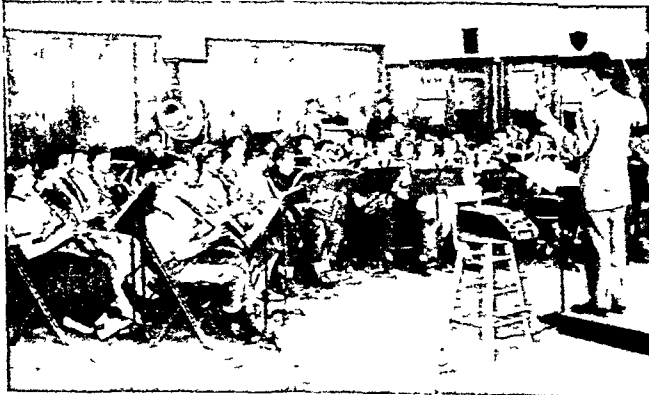
The work of the drum major is first to establish the beat for the band. He also signals, with his whistle and baton, the various steps and turns in marching formations. The drum major is traditionally a tall

person of commanding appearance, with his brilliant uniform topped by a high shako. His height enables the band to follow his baton easily. In recent years many bands have added girls as drum majorettes.

Marching formations have developed into such intricate and spectacular patterns that a band spends weeks in practice. The position of every player is plotted on charts which the band must memorize. College bands are especially noted for ingenious formations, such as a roaring tiger angrily lashing its tail or the moving and intertwining letters of the home team. Precision flag waving and electrically lighted instruments glowing at night events also delight the spectators.

In addition to the drum major and drum majorettes, many bands have special baton twirlers. Nowadays many boys and girls start as very young children to learn the tossing, and balancing tricks of baton twirling. Park districts, youth organizations, and many schools teach it, and there are several books of instruction in the skill. It is really not so hard as it looks as the baton seems to move much faster than it actually does. With practice, almost anyone can

PRACTICE AND TEAMWORK "MAKE" THE BAND—LARGE OR SMALL



Boys and girls of Carl Schurz High School in Chicago work toward entering a contest (left). Beside the conductor is a wire recorder, which will play back the music for correction.



"Let's have some country music, gentlemen!" A-hep and a-pat and the boys take off on their guitars and harmonicas (right). Amateur specialty bands are popular in broadcasting.

TO CHEER THE "BOYS IN BLUE"



The Elmira Cornet band of the 8th New York Militia poses at Arlington, Va., in 1861. In the Civil War Northern bandsmen, like these, also served as ambulance corps aids.

learn the spectacular tricks. Most twirlers prefer a heavy baton as the weight helps to keep it moving.

Great Bands, Leaders, and Composers

The first great bands in the United States grew out of military musical units. The oldest is the colorful United States Marine Band. Late in 1775 the Continental Congress authorized organization of two battalions of marines, including a band of fifers and drummers. After the Revolution they were disbanded but were reorganized in 1793. By 1800 the Marine Band had clarinets, French horns, oboes, a bassoon, and a bass drum. Thomas Jefferson was so interested in its development that he was called "godfather" of the band. It has played for every president of the United States except George Washington.

Another famous American military band was the Great Lakes Naval Training Station band led by John Philip Sousa in World War I. Today all branches of the armed services have well-trained bands. France's *La Garde Républicaine* band, established in 1802, raised the standard of music in Europe. One of the best-known band groups is that of a religious and social service organization, the Salvation Army.

The first notable bandmaster in the United States was Irish-born Patrick Sarsfield Gilmore, who developed gigantic concert bands just after the Civil War. He made his headquarters in Boston but toured the nation. The most famous of all was John Philip Sousa, the "march king," cornetist, bandmaster, and composer. Following him Patrick Conway, cornetist, toured the country with his Ithaca, N. Y., band and organized the Cornell University Cadet band. Arthur Pryor, "king of the trombonists," was one of the first great bandmasters to broadcast. Edwin Franko Goldman, cornetist, delighted thousands of New Yorkers with his band concerts on the Mall in Central Park. He also persuaded distinguished modern composers to write especially for the band.

Until relatively recent years bands usually had to get their musical arrangements by adapting orchestral scores to their instruments. Today, however, bands have especially composed music by such famous writers as Elgar, Grieg, Copland, Milhaud, Shostakovich, and Respighi. Among the leading bandmasters who composed were Sousa, Pryor, and Goldman.

Bands March Through the Ages

The word "band" comes from *bandha*, Sanskrit for the word "bind." In the literal sense a band is merely a group "bound" or "banded" together to play musical instruments. We usually think of a band as a group that plays chiefly wind and percussion instruments, as opposed to an orchestra, which is made up principally of strings (see *Orchestra*).

As far back as early Egyptian and Assyrian times, groups of men played reed instruments, tambourines, cymbals, harps, and drums. In the Old Testament the Book of Joshua tells how the seven priests "bearing seven trumpets of rams' horns" marched around Jericho "till the walls came tumbling down."

One of the earliest great military bands was formed by Servius Tullius in 570 B. C., who introduced bronze trumpets into the Roman army. The chief purpose of a military band is to keep large forces of armed men in orderly step. Some military bands have been cred-

NATIVE AMERICAN AND NATIVE GERMAN SPECIALTY BANDS



Fans listen to a variant of the jazz band (left). Jazz bands began in America. From them grew swing, boogie, and bop groups. Here swing and bop players mix in a "combo" (combination).



In the annual costume festival at Stuttgart, Germany, in 1954, a bandmaster accepts the cheers of spectators for his troupe of youngsters (right). Germans of all ages love band music.

ited with "turning the tide of battle," as when the Duke of Wellington's Highland pipers inspired the faltering Scots to throw back Napoleon at Waterloo. Cavalry bands also blared encouragement in battle.

Bands also kindle courage in daily life as when, in 1912, the heroic band on the sinking ship *Titanic* stayed at its post, giving comfort and strength by playing the hymn 'Nearer, My God, to Thee'.

Bands Come to America

In colonial America neither Puritans nor Quakers permitted bands; but the music-loving Germans, Dutch, and Swedes brought their old tunes to the new land. In the 1630's a little Dutch band played in New York City. Small German bands later entertained Boston with their lively "oompah, oompah" airs.

British troops brought bands with clarinets to the American Revolution. Washington's forces, however, usually had only drums and fifes, as shown in the picture 'Spirit of '76'. In the Civil War several Northern bands accompanied their local units.

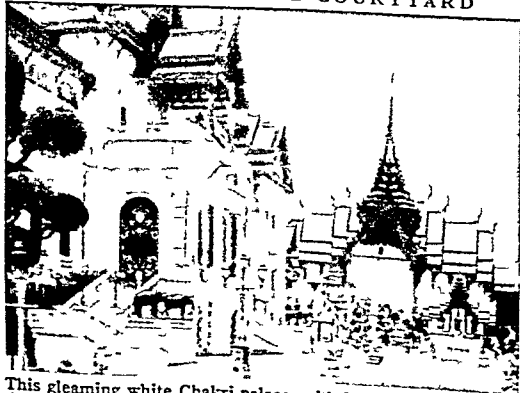
By 1900 band concerts were regular events in town and village life throughout the nation, with people crowding round the wooden bandstand in the square. Many factories organized employees' bands. Some employers, before hiring a man, asked if he could play a band instrument—he would work at his job in the factory, then "double in brass" in the company band.

In the early 1900's the public began to lose interest in bands as other forms of recreation developed. The first World War, however, with its many patriotic demonstrations, revived interest in bands and spurred the great popularity of college and school bands today. Attractive band shells, with good acoustics, have brought new interest in concert bands.

Books about Bands

- Goldman, E. F. *Band Betterment* (Fischer, 1934).
 Graham, Alberta. *Great Bands of America* (Nelson, 1951)
 Loken, Newt and Dypwick, Ots. *Cheerleading and Marching Bands* (Barnes, 1945).
 Prescott, G. R. and Chidester, L. W. *Getting Results with School Bands* (Fischer, 1938).
 (A series of pamphlets on baton twirling is available from Gamble Hinged Music Company, Chicago)

A BANGKOK ROYAL COURTYARD



This gleaming white Chakri palace, with its ornate formal garden, helps to make Bangkok a spectacularly handsome city. Note the elephant statues. The Siamese revere these animals.

BANG'KOK, SIAM (THAILAND). The "Venice of Asia" is Bangkok, capital of Siam. Thousands of people live in boats on the Menam River and its many canals. Modern bridges carry streets across the sprawling network. The newer, Westernized part of the city is laid out around the royal palace and its great parks. This section, with its brick buildings, electric lights, and streetcars, contrasts strangely with some 400 ornate, gilded Buddhist temples.

Lying about 20 miles from the mouth of the Menam, Bangkok is Siam's chief port. Its major exports are rice and teak; it imports cotton, silk, foodstuffs, machinery, and oil. Chinese and Europeans handle most of its trade. Population (1947 census), 827,290. Many are Chinese.

BANJO. With his great sense of rhythm, a Negro can strum the liveliest or saddest tunes from a banjo. The Negro poet, Paul Dunbar, wrote appealingly:

... I jes' lets down
 A banjo string or two
 Into the deepest of my heart
 An' draws up chunes for you.

The banjo has a round tambourinelike body made of parchment stretched over a frame, and a long neck. The strings, usually five in number, are plucked or struck with the fingers of the right hand while the fingers of the left hand lengthen or shorten them by pressure against the fretted neck.

BANKRUPTCY. In the days of the later Middle Ages, when the Italian cities were the money markets of the world, it was the custom to break the bench of any moneylender or banker whose debts became greater than the amount of his property. As his bench was his place of business, the breaking of it forced him to discontinue his former pursuit and also implied disgrace. From the words describing this custom (*banca*, meaning "bank," and *ruptus*, meaning "break") has come our modern word "bankrupt." From the custom itself comes the practice of all modern nations of forcing a man who cannot pay his debts—that is, who is a bankrupt—to discontinue his business. This is done by means of bankruptcy laws.

When the fathers of the United States drew up the Constitution, they put in it the provision that "Congress shall have the power to establish uniform laws on the subject of bankruptcies throughout the United States." According to these laws there is voluntary and involuntary bankruptcy. A debtor may become a voluntary bankrupt by filing a petition with the judge of the United States District Court, setting forth the fact that he is unable to pay his debts and that he is willing to surrender his property to his creditors. Any corporation (with certain exceptions) or any person (except wage earners and farmers) who owes \$1,000 or more may be declared an involuntary bankrupt by the district court if he in any way attempts to cheat his creditors or if he admits in writing his inability to pay his debts. In this case the creditors must file the petition. After a petition has been filed, either the judge of the court or a referee in bankruptcy to whom the judge may refer the case appoints a day on which

the creditors may present their claims. If it is decided that the debts of the man are, as is claimed, greater than his property, he is declared bankrupt, and his property is handed over to a trustee. The trustee sells the property and divides the proceeds among the creditors in proportion to their claims. As soon as the settlement is finished, the debtor is

discharged from bankruptcy and the remainder of his debts is canceled. He is able to start business anew, without carrying the burden of the old debts. The revised bankruptcy law of 1938 permits hard-pressed debtors who earn not more than \$3,600 annually in salary or wages to pay their debts in installments, but they may still choose bankruptcy instead.

The STORES that "Buy" and "Sell" MONEY

BANKS AND BANKING

The modern bank is a complex institution—a financial department store. But banking in itself is not a mysterious or secret process. A bank has two main purposes. First, it accepts and cares for deposits of money from people who do not immediately need it. It pays this money out at the order of the depositor and in some cases pays interest for its use. Second, it makes loans to people who need them and who are willing to pay interest on them and can give good security.

Bank loans help business in many ways. A farmer, for example, may borrow money against warehouse receipts for wheat, to be repaid when the wheat is sold. Or he may borrow to buy land, giving the bank a mortgage on the land as security. The merchant or manufacturer may borrow money to buy raw materials or finished goods for stock, or perhaps to tide him over until he collects money due from his customers. A bank also invests in bonds and other securities most of which can be turned into cash on short notice.

The success of a bank depends primarily on the judgment of its officers in making loans and investments. In the past most of a bank's funds normally went into loans. Today banks invest more money than they lend because there is a much smaller demand for loans.

The funds which a bank can lend or invest come not only from the cash deposited, but from the "promises to pay" deposited by borrowers. Each loan it makes creates additional deposits against which it can lend, in other words, gives it additional credit. The bank



must keep on hand ample funds to provide safety against possible losses on its loans or investments and sudden demands from its depositors. Its capital and surplus provide a margin of safety against such emergencies.

The character of a bank's investments is important, because they are the most "liquid" part of its assets—that is, the part most easily turned into cash. If a large number of depositors should withdraw their deposits and the assets were not easily salable, the bank would be obliged to "suspend payment," or decline to pay "Run" as sudden and numerous withdrawals are called, were once common in times of financial panic, when depositors became alarmed about the safety of their money. Today, however, the government guarantees small depositors' accounts.

When a bank fails, a "receiver," appointed by the comptroller of the

currency for a national bank, or by the state bank superintendent or commissioner for a state bank, winds up its affairs. Formerly the receiver might assess stockholders amounts equal to the par value of their stock. The Federal Banking Act of 1935 ended this "double liability" of stockholders in national banks after July 1, 1937, many states also have done away with it.

What Are a Bank's Liabilities?

A bank's statement explains what it has done with the money entrusted to it. The "liabilities" it shows account for the money paid in by stockholders and for the "time" and "demand" deposits held by the bank. A time deposit is one which the bank may hold for a specified period. It accepts such a deposit by issuing a certificate of deposit or by taking a savings

deposit. A certificate of deposit states that the money has been deposited in the bank and that the bank agrees to repay it on a specified date. The money can be withdrawn only by the presentation and cancellation of the certificate, but the certificate itself is negotiable.

Savings Accounts

In the United States, savings deposits are accepted at the savings department of a commercial bank, or at a special savings bank. Daniel Defoe, the author of 'Robinson Crusoe', is given credit for suggesting a special bank for savings in 1697, but the first savings bank was not opened until 1765, in Brunswick, Germany.

The first special savings banks in the United States were opened in 1816. They are now common in New York, New Jersey, and most of the New England states, but rare in other sections. They are regulated by the states, which prescribe what type of investments may be used for bank funds. Savings accounts, whether kept in a special savings bank or in the savings department of an ordinary commercial bank, are useful for smaller amounts, and for special purposes, such as Christmas or vacation expenses. The banks reserve the right to require notice, varying from 30 to 90 days, from the depositor, before paying out money in savings accounts.

An initial deposit of one dollar is enough to open a savings account in most banks. Whenever money is deposited or withdrawn the depositor fills out a printed form, called "deposit slip" or "withdrawal slip," which gives his name, the amount paid in or taken out, the date, and the number of his account. These slips the bank keeps. The depositor receives from the bank a "pass book," in which are recorded the deposits and withdrawals and the current balance. Banks ordinarily will not pay out savings except on presentation of the pass book. In small banks, where the banker knows every customer by sight, there is little danger that the money will be paid to an unlawful owner, but the bank is not liable if the pass book is lost and later presented by an unlawful holder.

The rate of interest on savings deposits has varied from 5 per cent to 1 per cent or nothing, according to the business conditions and local customs. Interest is usually credited on January 1 and on July 1. As most of the money deposited in savings banks is invested in bonds, the rate of return received by the bank on these investments determines the rate which it can afford to pay on its deposits. The difference between the average rate received from bonds and the rate paid on deposits is the major source of the bank's profits. Sometimes savings banks are not owned by stockholders, but by the depositors. These are called "mutual savings banks" and any profit made by them is prorated as dividends, usually once a year, among the depositors. Postal savings banks, operated by the government postoffice department, were first established in England in 1861, in Canada in 1867, and in the United States in 1911. In the United States, two

per cent interest is credited on balances up to \$2,500, which is the maximum accepted from any depositor.

Checking Accounts

If, instead of wishing to keep your money in the bank indefinitely, you wish to have it immediately available, you open a checking account. In small banks \$25 or \$50, in large banks \$200 to \$500, is the minimum average balance you will be expected to keep on deposit. The records of a checking account are kept in ledgers or on ledger sheets, just as for a savings account, so that the bank can tell at any moment how much money you have deposited, how much you have withdrawn, and how much is left. Checking accounts are the bank's "demand" deposits. United States banks will not honor your demand for more money than you have in the bank. Formerly, those whose credit was good might draw out sums in excess of the amount in their accounts, but "overdrafts" are now prohibited by state and federal banking laws.

Money is withdrawn from a checking account by means of a written order (called a check), dated and addressed to the bank, instructing it to pay to a person named, or to the bearer, a certain amount. Even if you wish to withdraw money from your own account, you must present a check, signed by you, and made payable to yourself or to bearer. The bank supplies each depositor with printed checks, but if you happen to be out of the printed forms, and write out the entire order in longhand, the bank will pay it. A check (also spelled cheque) is the commonest form of credit instrument (*see Credit*).

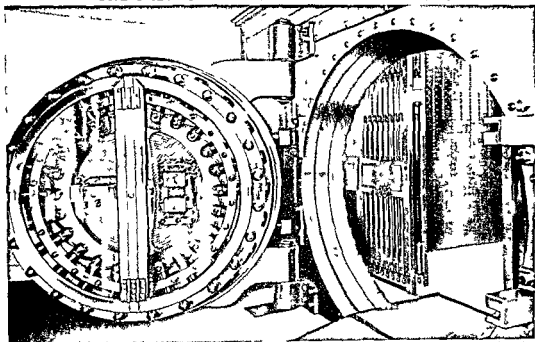
When the drawer of the check has not enough money in the bank to pay it in full, it is usually not paid by the bank on which it is drawn, but is sent back to the payee. Checks may be returned for other reasons, such as no signature, or no date, or a discrepancy between the written words of the amount and the figures. To avoid this danger it is common practise, when large amounts are involved, to have the check "certified" by the bank on which it is drawn. This is done by stamping across the face of the check "Accepted, _____ Bank," and having an officer of the bank sign the certification. A certified check is immediately charged against the maker's account, and becomes a liability of the certifying bank.

In business transactions a "cashier's check" is sometimes substituted for a certified check. A cashier's check is the bank's own promise to pay. It passes by indorsement like a personal check, but, unlike a certified check, it does not show on its face out of whose account the money will be paid.

Liabilities to Stockholders

So far, in the consideration of a typical bank statement, you have considered only one item, deposits, and the transactions and instruments which arise from them. Capital, surplus, and undivided profits are liabilities of the bank to its stockholders, not to depositors. If a bank is in difficulties, and if its assets are not sufficient to pay depositors in full, then these

THE TREASURE "CAVE" OF A MODERN BANK



Concrete and steel guard the safety deposit vaults where the bank and its customers lock up their valuables. That huge door that looks like the breast of a giant gun is proof against drills and dynamite. Behind those two semicircular panes of glass is the mechanism of the time lock. Once the 14 bolts in the door's rim are driven out and catch on the inside of the steel door casing they cannot be drawn back until the chronometer in the door marks the official opening hour.

three liabilities to stockholders may be wiped out by using the assets to pay depositors. Capital represents the face or par value of the bank's stock, usually at \$100 a share. Surplus may be "paid in" or "earned." If it is paid in, this means that the stockholders when the bank was organized paid a premium over par for their stock. This surplus is an added protection to the depositors. If it is earned surplus, this means that the directors instead of paying out each year all the profits the bank has made, have held back a part for use in the business. The distinction between surplus and undivided profits is not always clear, both being profits retained in the business, but dividends to stockholders may be paid out of undivided profits and reserves, although not usually out of surplus.

Reserves, Loans, and Discounts

Reserves are often set up on the bank's books to offset possible losses. Then if the loss occurs the bank will not be suddenly embarrassed by a decrease in estimated profits, and if it does not occur the profits will actually be increased. A reserve is merely an accounting device for insurance against future losses.

In accounting, an asset or a resource need not represent actual property, it may merely explain what has happened to it. Such a resource is the largest item on the asset side of the bank statement, namely, loans and discounts. A large bank divides loans and

discounts into three groups: demand loans, which the bank may require paid at any time; time loans on which the date of payment is specified; and real estate loans if there is a substantial percentage of these.

Some banks show a division of loans as collateral and "other loans." Anybody who owns bonds or shares of stock in a well-known corporation or has a warehouse receipt for grain, or some other evidence of property, may deposit it with a bank as collateral security and borrow money against it. Usually a bank will lend 60 to 80 per cent of the market value of the collateral. Then if the borrower fails to pay his loan, the ownership of the collateral reverts to the bank, which may sell it, returning to the borrower any excess over the amount of the loan, or holding the borrower liable for the difference if the collateral is sold for less than the amount of the loan.

Business men, however, do not always have collateral available. A large packing company, for example, may borrow millions of dollars from the banks on its credit, without pledging specific collateral. In such a case the bank takes the risk that the net assets of the company would pay the loan. When loans are made on credit, the bank is much more careful than when loans are made on collateral. It takes into consideration not only the financial condition of the borrower, usually requiring a statement of his assets and liabilities, but also considers his character, his stand-

ing in the community, his record in business, and his probable success in the present enterprise.

How the Clearing House Operates

After loans and discounts, the largest item on a bank statement should be cash on hand and due from banks. These two are usually lumped, because cash due from other banks is so certain to be paid that it is fair to treat it as cash. The phrase "due from banks" usually includes "clearings," a word which requires a long explanation. Obviously if there is only one bank in a community, all deposits and loans are made in that bank. If there are two banks, or in large cities dozens of banks, then some machinery must be set up to cancel the obligations of banks to each other as a result of the transactions of their customers or depositors. The chart on this page explains a simple example of such "clearing house" work.

In small towns, and in early days even in larger cities, it was customary for each bank, at the close of the day's business, to send messengers to the other banks and get from them the cash to cover the checks on those banks which the particular bank had received during the day. It is a legend, probably not true, that two London messengers, happening to meet at a coffee house, decided that it was easier to exchange checks there than for each to take the long walk to the other's bank. Gradually other clerks learned of this practise, and the coffee house became an unofficial clearing house. The London clearinghouse began to function formally about 1775, and moved into its own building in 1810. The New York clearing house, largest in America, was organized in 1853.

The clearing houses in the United States perform many vital functions about which the public knows very little. All members of the clearing house association have their accounts regularly audited by examiners, appointed by the association. This audit is in addition to the bank's own audit and the audit made by the state or federal bank examiners. The clearing house association has helped to eliminate bad banking practise among its members, and has helped weak banks through difficulties.

There is no super clearing house to clear checks between cities. If you deposit a check in your bank drawn on a bank in another city, it is forwarded by your bank to its "correspondent" in the other city, and is there sent through the local clearing house. The funds may then be kept to the credit of your

bank on the books of the correspondent, or they may be transferred to some other bank as your bank may direct, but almost never is there any actual transfer of currency. For its services in collecting out-of-town checks, a bank may charge a small fee, usually from five to twenty-five cents, called "exchange." Banks which belong to the federal reserve system may have out-of-town checks collected through the federal reserve banks without charge (see Federal Reserve Banks).

State and National Banks

Banks in the United States may be organized either under the authority of the national government or of any of the states. National banks receive their charters from the Treasury Department, and their books are audited periodically by examiners appointed by the comptroller of the currency. The bank, however, is not run by the government, and the latter is not liable for its debts. State banks are chartered by the state and operate under state laws. There are also private, or unincorporated, banks, conducted by individuals or partners; but the Banking Act of 1933 required such banks to permit examination and publication of their financial condition. The powerful New York house of J. P. Morgan & Company was a private bank until 1940, when it became a state bank. The 1933 law also forbade so-called "investment bankers," who really are dealers in securities, to receive deposits,

and forbade banks to deal in securities, because the desire to sell securities sometimes led to bad banking practises.

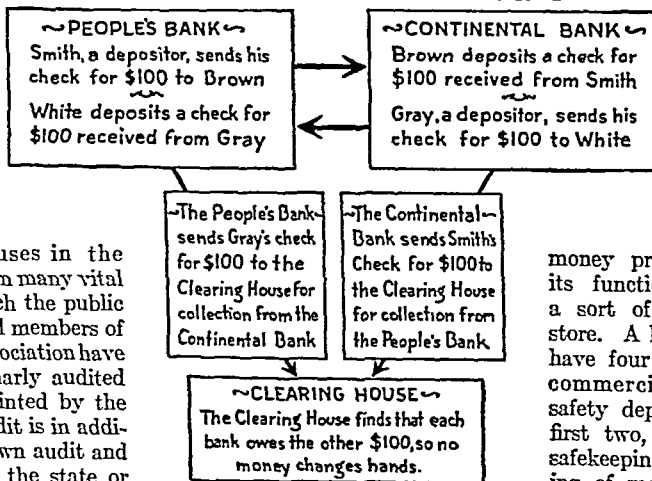
Other Departments

The large bank, because it deals with all kinds of money problems, has extended its functions until now it is a sort of financial department store. A large bank usually will have four distinct departments: commercial banking, savings, safety deposit, and trust. The first two, which deal with the safekeeping, borrowing, and lending of money, have been fully described. The safety deposit department was an obvious outgrowth of the bank's need for

guarding its own treasure. Customers were first allowed to keep their valuables in the bank's vaults; later, a special box was provided for each customer, to which he alone had access, and for which he paid rent.

Modern safety deposit vaults are almost impregnable. The largest of them have an outer wall of reinforced concrete, from 8 to 18 inches thick, entirely enclosing a steel wall, built of two or more plates,

HOW BANK CHECKS ARE "CLEARED"



A simple example showing how the Clearing House balances the checks received from one bank against those of the other, to prevent, so far as possible, the transfer of cash.

each an inch thick. Sometimes highly sensitized telephonic microphones are attached to the steel plates. Even the lightest tap against the vault walls will cause the microphones to set off a police alarm.

The next step in the development of the financial department store was the trust department. So far the typical bank was handling its customer's affairs *with his full knowledge and only at his request.* It was logical to say to a customer that the bank could take care of all these details without bothering the customer—for example if he left town for several months, or even after his death. A vast trust business will handle financial affairs ranging from clipping coupons and collecting dividends to managing estates and business enterprises (see Trusts).

The United States Banking Act of 1933 in addition to requiring examination of all banks created a Federal Deposit Insurance Corporation, with 150 million dollars subscribed to its stock by the government, and further subscriptions from the Federal Reserve banks and members of the federal reserve system. The Federal government provides for insurance of deposits up to \$10,000 in all banks which are Federal Reserve members. Non member banks may obtain insurance if their financial condition is approved by the Insurance Corporation. But state banks with deposits of \$1,000,000 or more, after July 1, 1942, must be Federal Reserve members to obtain insurance. Insured banks must contribute annually $\frac{1}{2}$ of one per cent of their total deposits to a fund for paying depositors of any bank which cannot meet its obligations.

What Happens When a Bank Fails

How can a bank fail when its "statement" gives no warning? The reason is, the statement shows book values, or costs, of the assets and not the current or actual value. The money may have been used to buy bonds which are now depreciated and cannot be sold except at a loss. It may have been used to make loans on real estate which is no longer worth the original cost on which the loan was based, and even if it were, it could not be sold during a depression such as began in the United States in 1929. Or the money may have been loaned to men or corporations for use in business, and the borrowers may have been unable to repay the loan when due.

Meanwhile, what are the depositors doing? As they ask for their money, either because they need it or because they are afraid that the bank will close, the bank must sell some of its assets or retire loans. Naturally, the first loans paid and the first assets sold are the best, those which are most liquid and show no loss. As the deposits continue to be withdrawn, there may come a time when the assets remaining can not be sold except at such a loss as would not pay the remaining deposits in full. Perhaps some of the assets can not be sold now at any price, they are "frozen." When such a point is reached the bank must be closed, to allow time to dispose of the assets, and

also that all the depositors may share in such cash as becomes available when the assets finally are sold.

History of Banking

Banking is as old as history, although it was once frowned upon because the taking of interest was considered immoral and some nations forbade their citizens to engage in it. The temples of Babylon, Egypt, and ancient Greece were the safe-deposit vaults of their day. Money-lenders are mentioned in the most ancient Hebrew history. A Roman ordinance of 210 B.C. set aside a place in the Forum for the money-changers who bought and sold foreign coins. The Justinian code of 529 A.D. included laws governing the lending and trading in money. For more than two centuries from 1100 the Templars engaged in almost all the functions of the bankers of today. The money-changers of Italy in the Middle Ages did business in the street from a bench, in Italian *banco*, which gives us our word bank.

Modern banking may be dated from the Banco di Rialto, established at Venice in 1587. It accepted demand deposits, and permitted the depositors to transfer their credits by checks. It was absorbed in 1619 by the Banco del Giro, which gave receipts for gold or silver coins deposited. The receipts were used as money. This bank survived until Napoleon liquidated it in 1805. The Bank of Amsterdam, organized in 1609, also issued credits for deposits which served for what was called "bank money."

The first real bank notes were issued in 1661 by the Bank of Sweden to eliminate the handling of copper coin. Goldsmiths were the bankers of England until the Bank of England was incorporated in 1694 with a capital of £1,200,000. Except for private bankers it held a monopoly of banking in England until 1825. The Bank of France was formed in 1800. Sweden, Canada, Argentina, and other nations now have large state banks or central banks which act as agents for the government in its financial affairs.

Banking in the United States

The first regular bank in the United States was the Bank of North America at Philadelphia, chartered by the Congress of the Confederation in 1782. In

15 SIGNATURES AT ONCE

Banks require actual signatures on every check. This device meets the need. As the signer moves the master pen the 15 attached fountain pens follow each stroke precisely.



colonial days there were a few small local organizations which issued notes against mortgages, dwellings, live stock, and other security, but they did not carry on a general banking business. The various colonies issued their own paper money, and the states continued the practise until the adoption of the Constitution in 1789 (see United States Constitution, Article 1, Section 10).

Alexander Hamilton was largely responsible for the creation of the first Bank of the United States, which was chartered by Congress on Feb. 25, 1791, for 20 years. The government took \$2,000,000 of the authorized capital of \$10,000,000, and notes of the bank were made acceptable for all debts due the government. Its greater capital, its eight branches stretching from Boston to New Orleans, and its close connection with the government enabled the Bank of the United States to dominate the country's banking. The government sold its stock, however, and the bank's charter was not renewed in 1811 because of opposition from the 80 or more state banks.

In the next five years state banks multiplied, and turned out more than \$60,000,000 in paper currency. During the War of 1812 nearly all of the banks suspended payment of specie against their notes. The country's finances were in such a critical condition that Congress reversed its decision of 1811 and again chartered a strong central bank, the second Bank of the United States, in 1816. The government subscribed one-fifth of the \$35,000,000 capital and made the bank the official depository of government funds. It prospered until its officers mixed in politics, and incurred the enmity of President Jackson (see Jackson, Andrew). He vetoed the bill to renew its charter, and ordered government funds withdrawn, but the bank continued under a Pennsylvania state charter until it was wrecked in the great financial panic of 1837.

That panic wiped out more than 100 state banks which had loaned large sums, including government funds, on speculative securities. State banks were the only recognized banks until the Civil War broke out in 1861, and some of them issued as many as six different varieties of notes. It was so difficult to know what notes might be of actual value that there was a general discount on all paper money, running sometimes as high as 15 per cent. Counterfeit money, and money issued by "wildcat" banks—banks with no real securities behind their notes—made the general financial confusion worse.

National Banks

The present system of national banks in the United States grew out of the government's need of credit in the Civil War. A law passed in 1863 permitted banks to organize under a national law and to issue notes up to the amount of their capital, secured by government bonds deposited with the Treasury. In 1864 the law was replaced by another which established a bureau in the Treasury Department to supervise national banks, with a comptroller of the currency in charge. A minimum capital of \$50,000 for

banks in places having less than 6,000 population was and still is required. In 1933 the minimum requirement for new national banks was set at \$100,000 for places between 6,000 and 50,000 population, and \$200,000 for banks in larger places.

State banks were slow to join the national system until the law of 1865 levied a tax of ten per cent on all state bank notes. This brought many state banks into the new system. After the panic of 1907, and again after the first World War, there was a trend toward centralization of banking power. This was due first to creation of the Federal Reserve System (see Federal Reserve System), and then later to the spread of branch banking. A few states do not allow banks to operate branches, but most of them permit branches in the city in which the main bank operates. Branch banking has reached its greatest development in California, which permits state-wide branches. Over half of the bank resources of the country are included in branch systems. A federal law permits national banks with \$1,000,000 or more capital to maintain branches in foreign countries.

Chain banking, or group banking, serves practically the same purpose as branch banking. A chain consists of many banks owned by one large bank or by an affiliation of corporations. Canada has a nation-wide system of branch banking really dominated by four banks. There are only about a dozen main banks chartered in the Dominion, with some 4,000 branch banks.

The banking crisis of 1933 (see Roosevelt, Franklin D.) forced the temporary closing of all banks throughout the United States. No bank was allowed to reopen until it had been examined and found in good condition. About 4,500 banks failed to reopen, and the country was left with some 15,000 banking institutions, having assets estimated at the time as worth well over 50 billion dollars. About two-fifths of them were national banks. Only a small proportion of the state banks then belonged to the Federal Reserve System; but provisions in the Banking Act which followed the crisis, such as deposit insurance, put strong pressure on all banks to join the system.

Small-Loan Institutions

Commercial banks as described above seldom provide accommodations for the small borrower who has no assets except his earning power. To meet his emergency needs, many kinds of small-loan institutions have arisen, which lend money on unsecured notes, sometimes requiring salary assignments, indorsement by friends of the borrower, or a *chattel mortgage* on his furniture or automobile.

Most states regulate the small-loan business by laws against "usury," that is, exorbitant interest charges. In spite of these laws, "loan sharks" still charge usurious rates by including "service charges," by deducting interest in advance, and by charging interest on the entire sum loaned for the whole term of the loan while the borrower repays in weekly or monthly instalments. To help the small borrower, some banks have established small-loan departments which lend

to trustworthy persons at commercial rates. Such loans are often substituted for installment buying.

Credit Unions

Loans which depend chiefly on the good character of the borrower for security are best made by persons who know him. Federal or state credit unions—cooperative small-loan banks—furnish loans at low rates from funds supplied by neighbors or fellow workers. As few as seven members can incorporate under federal laws to form a credit union. It can lend members' money to members at reasonable interest rates.

There are more than 10,000 credit unions in the United States, with more than 4,000,000 members. *Labor banks organized by labor unions include thousands of members with millions of dollars in deposits.* Federal credit unions are owned and controlled by their members under government supervision. The members must have some bond of association or occupation. A committee of members approves all loans. Members' dividends are limited to 6 per cent. (See also *Banks and Banking* in the *Fact-Index* at the end of this volume.)

BANTING, SIR FREDERICK GRANT (1891-1941) and **BEST**, CHARLES HERBERT (born 1899). Once the disease called diabetes was a dread killer of children and adults. Today thanks to *insulin*, victims of diabetes can enjoy a nearly normal life. This life-saving drug was discovered by Frederick Banting, a young surgeon of London, Ontario, and his assistant, Charles Best, a medical student.

When Banting began studying diabetes, doctors knew that the disease was caused by a disturbance of the pancreas which kept the body from digesting carbohydrates, such as sugar and starch. They knew that this use was controlled by a hormone secreted by certain cells in the pancreas, called the *islands of Langerhans*. Apparently, lack of this hormone caused diabetes. But attempts to isolate the hormone had failed.

Banting reasoned that the failures were caused by other substances in the pancreas. These were the enzymes that promote digestion. Normally they pass out through the pancreatic duct, while the hormone is absorbed in the *blood*. But if a healthy pancreas is removed from an animal the enzymes destroy the hormone before it can be extracted.

Banting decided to tie off the pancreatic duct of a dog to cause atrophy of the glands that produce the enzyme. This would allow extraction of the hormone. Banting obtained permission to use a laboratory in the University of Toronto medical school during the summer of 1921, and Best joined him. On July 30, 1921, they removed the pancreas from a dog whose

pancreatic duct had been tied off. Without its pancreas, the dog sank into a diabetic coma. They ground up the gland and prepared a solution which they injected into the dog's veins. In a few hours the dog's diabetic symptoms were greatly reduced.

This was proof that the solution contained the vital hormone. At first they called the hormone "*isletin*" coming it from "*islet*" or *little island*, after the *islands of Langerhans*. Later they accepted an older term, "*insulin*," from the Latin word for *island*. Two years passed in further experiments and in developing a method for extracting insulin in quantity from the pancreatic glands of slaughtered cattle. By 1923, the drug was available for general use.

Frederick Banting was born on an all-but-pioneer farm near Alliston, Ontario, Nov. 14, 1891. The family prospered and Fred's father was able to send him through medical school. He received his degree in 1916 and served as an army medical officer in the first World War.

He began practice as a surgeon in London, Ontario, and served as an instructor in physiology in a local medical school. His interest in diabetes was awakened as he prepared to instruct his class on the pancreas.

After he discovered insulin Banting was showered with honors and degrees. In 1923 he was the co-winner of the Nobel prize in medicine and divided his share of the prize money with Charles Best. In 1930 the University of Toronto dedicated the Banting Institute to him. There he continued his medical researches. In 1934 he was knighted. Banting again served as a medical officer during the second World War. He

was killed in an airplane crash on Feb. 21, 1941.

Charles Best was born Feb. 27, 1899, in West Pembroke, Me. After insulin was discovered he was busy with research on manufacture and use of the drug. He took his M.D. degree in 1925 from the University of Toronto, and like Banting, received many honors. He remained at the university in several capacities and was appointed professor of physiology in 1929.

BANYAN TREE This remarkable tree of tropical

Africa and the Indian peninsula sends down great numbers of shoots from its branches. The shoots take root and become new trunks. A single tree thus may spread over a very large area. A specimen in the Calcutta botanical garden, more than a hundred years old, has a main trunk 13 feet in diameter, 230 trunks as large as oak trees, and more than 3,000 smaller ones. It is said that 7,000 people once stood beneath it.

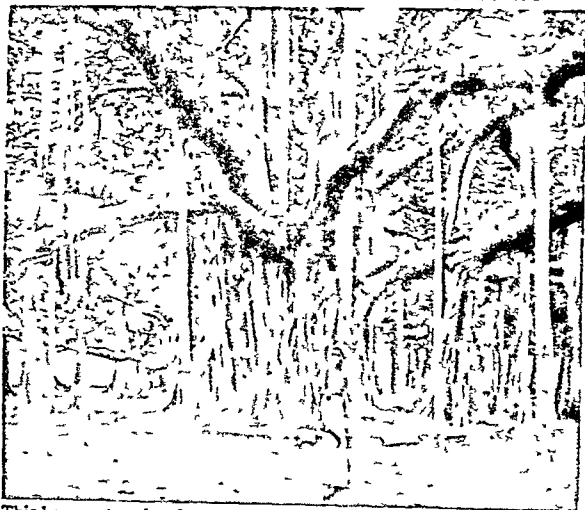
The banyan often grows to a height of over 70 feet and lives through many ages. Its original trunk may decay, leaving the younger ones to support the tree.

BANTING AND BEST



By their discovery of insulin Banting and Best brought relief and comparative good health to diabetic victims.

A TREE WITH HUNDREDS OF TRUNKS



This banyan tree has become a small forest. The parent trunk, almost out of sight, may decay, leaving the shoots to hold up the tree.

It has large heart-shaped leaves and inconspicuous blossoms followed by cherrylike scarlet fruit which furnishes food for birds and monkeys. The banyan has been naturalized in many tropical countries. Among the Hindus the banyan is held sacred and its bark is considered a tonic. The wood is light, porous, and of no value. Scientific name, *Ficus benghalensis*

BARBADOS (*bār-bā'dōz*). The self-governing British island colony of Barbados, the easternmost of the West Indies, is no larger than an average United States county. Yet it has nearly 200,000 inhabitants and it is one of the most densely populated regions in the world. Because of the pressure of population many of the men emigrate to find work. Three fifths of the inhabitants are females. Women and girls are seen everywhere skillfully carrying on their heads the goods they have for sale.

Negroes outnumber whites about fifteen to one and have equal rights in the schools, in the churches, and in politics. Negroes hold many important posts.

England obtained the island by settlement about the year 1627. The colony is administered by a governor, an executive council, and a legislative council, all appointed by the British home government, and a house of assembly elected by the people. The capital is Bridgetown.

Coral reefs fringe the coasts of Barbados. The land surface has a few forests and streams and is el-

evated in the interior. The highest point, Mount Hillaby, rises to 1,104 feet. Most of the island (area, 166 square miles) is under cultivation, chiefly for sugar cane, but also for cotton, coffee, bananas, and tobacco. The chief exports are sugar, fancy molasses, and rum. The clean trade-wind breeze, excellent drainage, and pure water make the island a pleasant health resort. It is patronized alike by northerners in search of a mild winter climate and by people of the hot, malarial, lowland regions of the tropics. George Washington's only journey abroad was to take his sick brother there in 1751. Hurricanes sometimes take fearful toll of lives and property. Barbados (the Portuguese word for "bearded") probably takes its name from the bearded fig tree which grows there. Population (1946 census), 192,800.

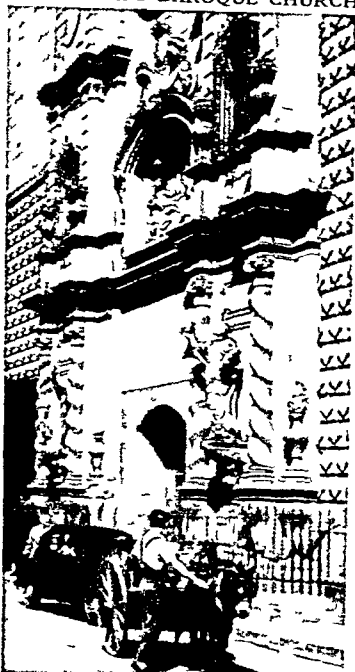
BARCELONA, SPAIN. The business and industrial center of Spain is Barcelona. It is the second largest Spanish city. Barcelona faces the Mediterranean near the foot of the Pyrenees in north-eastern Spain. It is the chief Spanish port and one of the major maritime cities of the Mediterranean basin. As the capital of four provinces in Catalonia, it has long been a leader in seeking the right of self-government for the Catalans.

Barcelona has been called a "restless and enterprising city." Its climate is more even and comfortable than that of most Spanish cities and encourages people

to work. Barcelona also has the advantage of hydroelectric power from the Ebro River. This cheap supply powers Barcelona's large chemical and textile industries. It specializes in cotton manufactures but also produces woolens and silks. The city imports chiefly raw cotton, hemp, coal, grain, and food. Its exports include textiles, leather goods, machinery, olive oil, fruits, and wine. Despite its relative "hustle," unusual in Spanish cities, Barcelona keeps many colorful old customs and has a rugged charm. The old part of the city was once guarded by medieval walls. In the great days of Mediterranean trade it gained a reputation for robust manners like that of Marseilles. The newer sections of the city have splendid hotels, parks, theaters, and apartments. Visitors delight in the sea foods of Barcelona and the surf bathing under brilliant skies.

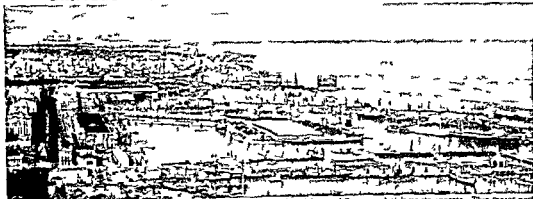
Barcelona is thought to have been founded by Hamilcar Barca in the 3d century B.C.; hence its ancient name, *Barcino*. It became a Roman colony, then fell succes-

BARCELONA'S BAROQUE CHURCH



Nuestra Señora de Belven, "Our Lady of Belven," is Barcelona's oldest parish church. It dates from the 17th century.

BARCELONA'S GREAT HARBOR ON THE MEDITERRANEAN



Ships from all nations bring raw materials to Barcelona the chief industrial city of Spain and pick up its exports. This major port of Spain was the first city in Europe to establish maritime insurance and a court of commerce.

sively into the hands of the Goths Moors and Franks. Barcelona became a great port in the 12th century. In the 16th century it lost some of its trade to Spain's ports on the Atlantic. It regained importance in the 19th century.

During the last year of the Spanish civil war 1939 Barcelona was the seat of the Republican Government. Many of its buildings were damaged by air raids. Population (1950 census) 1,280,179.

BARK. The stems of trees and shrubs are covered with bark which protects them from injury. Each species has a characteristic bark and it is possible to identify the plant by its bark alone.

The outer bark is a heavy waterproof layer called the *epidermis*. It is punctured by breathing pores called *lenticels* through which air enters the interior of the plant. The middle layer is the *cortex*. The third layer is the inner bark called *phloem*. It consists of tiny tubes which carry plant food manufactured by the leaves down through the branches and trunk and into the roots. Under the phloem is a single layer of cells known as the *cambium*. It is in the cambium that growth in the diameter of the plant takes place. Cambium builds cells on the inside that form new wood and on the outside it builds cells that make the bark. (see Trees)

At first these bark cells are soft and full of living material but later they collapse and the cambium builds successive layers of cells inside them thus pushing them out until they become dry hard and inelastic. The pressure causes the bark to split into ridges scales or strips since it is too dry to stretch. The bark protects the plant in many ways especially

from attacks of fungi and insects. It should never be hacked off leaving the wood exposed.

The bark of many kinds of trees is of great commercial importance. That of oak and hemlock is used for tanning leather. Very important medicines and dyestuffs are made from bark. Quinine for example is made from the bark of the cinchona tree and cascarilla which is widely used as a laxative comes from the bark of the California buckthorn. Stick cinnamon used as a spice is the rolled inner bark of a small East Indian tree and cork is the rough outer bark of a species of oak. Almost every boy has learned how to remove the bark on willow twigs by pounding to make a whistle. The Indians made strong light canoes of the bark of certain birches. From the pliable fibers of certain other bark savage tribes made coarse cloths for rugs and clothing.

BARLEY. The most ancient food of mankind according to the historian Pliny was barley our fourth most important grain. Barley was found in the excavated lake dwellings of Switzerland belonging to the Stone Age. Chinese sacred books claim that it was known in China 20 centuries before the birth of Christ and the ancient Hebrews used the grain while they were in Egypt for it is referred to in Exodus.

In appearance barley is not unlike wheat but it will grow in climates too cold for the latter grain. It is cultivated from the arctic region of Alaska to tropical India and it grows wild in western Asia. Barley ripens in a shorter time than does wheat so it can be sown in the spring later than wheat and harvested before the wheat is ripe.

In the United States barley is grown largely north and west of

VARIETIES OF BARLEY



In this picture A and B are two-rowed varieties. B has the awns or beard removed. C and D are six-rowed varieties. D is a commonly grown form in which the two outer rows dorsally so form as they look like a single row. C represents the true six-row or club variety.

the limits of profitable corn culture. It needs a well-drained soil but does not thrive on sands.

The well-known varieties of barley belong either to the six-rowed type (*Hordeum vulgare*) or the two-rowed type (*Hordeum distichon*). In dense six-rowed barleys, each of the three one-flowered spikelets borne at each joint of the rachis (axis of the spike or head) is fertile. The so-called "four-rowed" barleys have loose heads with every spikelet fertile, but have only two regular rows of kernels; the other four so overlap that only four rows appear. In two-rowed barley only the middle spikelet of the three matures its kernel. As the "four-rowed" type is poorer in quality, it is raised only in the northern latitudes, to which it is better adapted than the others, as it is extremely hardy.

Barley is not used as a food so much as are other grains, for it has little gluten in it. Still, thousands of peasants in Europe eat the black barley bread. The round grains, called pearl barley, and the patent barley flour are used for thickening soups, for making gruel for invalids, and for modifying cow's milk for babies. The chief uses of barley, however, are as stock feed and in the preparation of malt (*see* Malt).

BARNACLE. A single barnacle is the most harmless of creatures. But millions of these shrimplike seaweaving animals fastened to the bottom of an ocean liner may slow down its speed by half and greatly increase its fuel consumption. In one year's time a 10,000-ton ship may acquire 30 tons of barnacles. Fresh water kills them, but the only way to remove the shells is to put the ship in dry dock every six to eighteen months and scrape it clean. Paints containing poisonous oxides of copper or mercury and synthetic resins are only partially effective in discouraging these expensive free riders.

Barnacles are shellfish related to the lobsters, shrimps, and crabs (crustaceans). Most of them are very small, only about half an inch long, with thick, ridged shells of overlapping plates. The word barnacle comes from the Old Irish word, *bern*, meaning a ridge or cleft.

About 200 species of barnacles are known. Most common are the rock, or acorn, barnacles, found attached to wooden pilings and rocks along the sea-coasts; and the stalked, or goose, barnacles, on ship bottoms. The body of the latter is raised on a fleshy, leathery stalk. The name goose barnacle comes from the belief held in the Middle Ages that it was the young of a bird, the barnacle goose. One kind of barnacle in Chile is prized for soups and chowders. Japan has long used barnacles as fertilizer.

Barnacles have a strange life history. With a few exceptions, most kinds are both male and female. The individual fertilizes its own eggs, which it retains within the shell until they hatch as larvae. Each barnacle produces millions of larvae. As the larvae hatch, they issue from the parent in clouds.

After freely swimming about for a time, the larva undergoes changes, develops a shell, and then seeks to fasten itself to a solid object—the bottom of a ship, a rock, wooden piling, or the body of another animal, such as the sea turtle and the whale. During this early period of their lives the larvae are without defenses of any kind and are food for fish and other sea creatures. Comparatively few of them survive to "settle down."

When it has found the support it needs, the rock barnacle attaches itself at the head end by means of two antennae with suckerlike discs that exude a cement. The goose barnacle is attached by the stalk. The body is raised on the stalk upside down, with the

head at the stalk end. The exposed end of the shell of all barnacles opens and closes by means of a jointed lid (*operculum*). It has six pairs of slender, tendrillike legs called *cirri*. They are jointed, two-branched, and heavily fringed. The barnacle lies on its back inside the shell, and, thrusting the legs outside, sweeps them through the water and scoops in minute plant and animal life.

Barnacles belong to the order *Cirripedia* ("curly footed") of the class *Crustacea* ("crusted"). The scientific name of the acorn, or rock barnacle is *Balanus balanoides*; of the goose barnacle, *Lepas fascicularis*.

THE COMMON ROCK BARNACLE OR "ACORN SHELL"



The rock barnacle, unlike the ship barnacle, is not a nuisance to man. Notice the slender, feathery legs. Barnacles have been described as "animals that sit on their heads and kick food into their mouths." This is a picture of a model in the American Museum of Natural History.

BARNUM PHINEAS TAYLOR (1810-1891) In an age when there were no radios or motion pictures and few other means of public entertainment P T Barnum gave amusement to millions of people Early in his career as a showman this shrewd and jovial giant of a

man decided that the public loved to be fooled Typical of his many hoaxes that thousands of people paid to see was the

Feejee Mermaid This fake was contrived by joining the stuffed tail of a fish to the mummified head and shoulders of a monkey Barnum fooled the public so often that he became known as the Prince of Humbug Later in his career he presented genuine curiosities which were received with equal enthusiasm

Barnum was born at Bethel Conn where his father was tailor storekeeper and farmer He received little schooling but his training in strict economy and hard bargaining developed his naturally sharp wits When he was 14 his father died and the boy was left to support himself He clerked in a store He conducted lotteries He edited his own small but sensational newspaper Each type of work taught him more of human nature

Publicity the Basis of Barnum's Success

His career as a showman began in 1836 His first exhibit was Joce Heth a Negress who claimed that she had been George Washington's nurse Other people had made a failure of exhibiting Joce because they lacked Barnum's genius for advertising He aroused interest in his exhibits by using flamboyant posters exaggerated descriptive notes brass bands and parades He used high-sounding and mysterious words to stir curiosity and moreover took care to appeal to people's sentimentality love of learning and national pride Once he was asked to give his rule for success as a showman With good natured cynicism he answered that it was a thorough knowledge of human nature which of course included the faculty of judiciously applying soft soap His publicity methods introduced the era of modern advertising

In 1841 Barnum bought the run-down American Museum and by crafty publicity built it into a New York pleasure center His most famous attraction was the American dwarf Charles S Stratton whom he named Gen. Tom Thumb Barnum toured Europe with the General and presented him to Queen Victoria Another of his famous exhibits was Jumbo a huge African elephant which he advertised as the Only Mastodon on Earth He achieved a sensation in 1850 by engaging Jenny Lind the Swedish Nightingale

for a tour of the United States—the first time a foreign singer had been brought to American shores Barnum's circus career was equally successful He was not the first circus owner in the United States But he became the greatest of his time In 1870 he combined many of



Phineas T Barnum

his traveling entertainments into one tremendous circus the Greatest Show on Earth Its travel expenses were \$5 000 a day In 1880 he joined his chief rival J A Bailey and by 1887 the two shows were called Barnum and Bailey's Circus (See Circus)

Barnum several times suffered severe financial losses through fires and unfortunate business connections but he fought his way back to success—once by lecturing on The Art of Money Getting He was a great temperance advocate and one season he gave free lectures on temperance His book The Life of P T Barnum Written by Himself was a candid mixture of trickery and bluff honesty He built a pretentious oriental home at Bridgeport Conn and became mayor of that city in

1875 Among the many distinguished men who were his close friends were Greeley and Mark Twain

BAROMETER Many a vessel at sea has been saved because the ship's glass warned the captain in time that a storm was approaching The ship's glass belongs to the family of instruments called *barometers* named from the Greek words meaning pressure measurers They measure the pressure of the atmosphere The weather man relies on them in his work The *altimeters* that tell aviators and mountain climbers the height above sea level are members of this family

We know that the weight of the air above us causes a pressure that at sea level averages about 14.7 pounds per square inch (see Atmosphere) As we climb to higher altitudes the pressure decreases We know also that at any given altitude the movements of hot and cold air that cause weather disturbances alter the atmospheric pressure (see Rainfall Storms Winds) Thus by measuring these pressure changes barometers can give us information both about altitudes and weather

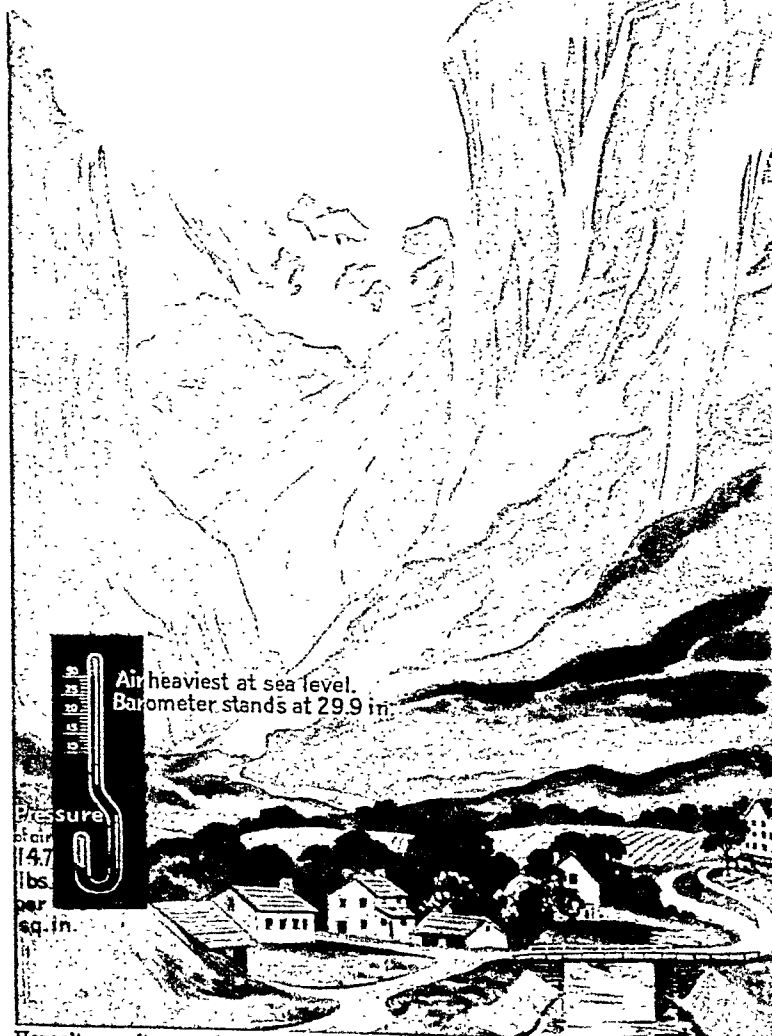
Barometers are like weighing machines They measure the weight or force needed on one side to balance the pressure of the atmosphere on the other The most familiar form is the *mercury barometer*

The Mercury Barometer

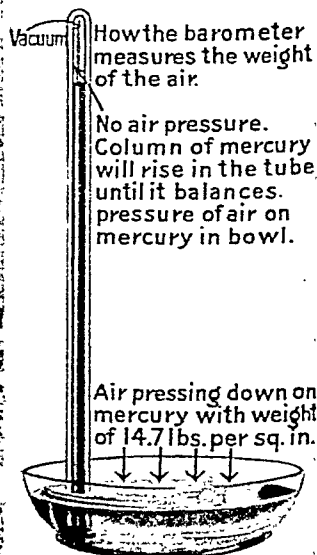
To determine at the lower right of the following page is a simple way to make a mercury barometer Pour about an inch of mercury into a glass dish Then fill with mercury a 3-foot glass tube which has been sealed at one end Now close the open end with your

HOW BAROMETERS MEASURE MOUNTAIN HEIGHTS

Air much lighter
at 3 mi. Barometer
stands at 15 in.



Air heaviest at sea level.
Barometer stands at 29.9 in.



Haven't you often wondered how men measure the height of mountains? This picture shows one way in which it is done. The height of a mountain means its height above sea level. At sea level the barometer stands normally at 29.9 inches. As the instrument is carried up higher and higher, the air pressure becomes less and less. The diagram (lower right) shows the principle of the barometer. The pressure of the air forces the mercury in the bowl up into the vacuum tube, until the weight of the column of mercury exactly balances the air pressure, just as a pound of sugar on the scales balances a pound weight.

thumb invert it plunge it into the mercury in the dish and remove your thumb. Mercury will then run out of the tube into the dish until the weight of the column of mercury in the tube exactly balances the outside air pressure. If the outside air pressure increases mercury from the dish will be forced up in the tube. If it decreases mercury in the tube will fall.

The exact measure of the air pressure at any moment is the height of the mercury in the tube above the level of the mercury in the dish. Under standard conditions at sea level the height will be 29.92 inches or 76 centimeters. At an altitude of 10,000 feet the mercury column will be only 20.5 inches high; at 20,000 feet 13.75 inches; and at 30,000 feet 8.9 inches.

Variations at sea level caused by the weather may range between 27 and 31 inches. A rising glass due to high pressure indicates fair weather; a falling glass due to low pressure indicates the approach of a storm (see Weather).

The principles of the barometer were discovered by the Italian physicist Evangelista Torricelli through experiments that he performed in 1643. In modern barometers the open dish of mercury is replaced by an enclosed reservoir with only a tiny opening to the outside air. The shape of the reservoir has no effect on the pressure registered. In its simplest form the reservoir may be merely an upbend of the barometer tube. Such a *siphon barometer* is pictured in the lower left corner of the opposite page. In the *Kew* or *aniline* type of instrument the scale markings take into account the differences between reservoir and tube levels. The *Fortin* type has a device for adjusting the reservoir to a fixed level so that the readings may be taken from a uniform scale.

Mercury is used because it is the heaviest of liquids. A water barometer would require a tube more than 34 feet long and the water of course would freeze at winter temperatures. Furthermore water and most other common liquids release vapor that would decrease the vacuum at the top of the tube, whereas cold mercury releases very little vapor.

The Aneroid Barometer

The cumbersome and fragile mercury barometer is replaced for many purposes by the *aneroid* (from Greek words meaning "not liquid") type of instrument. The *aneroid barometer* is extremely sensitive though it

does not retain its accuracy as well as the mercury barometer. Light and sturdy, it is by far the commonest type of barometer for household use and for many scientific purposes. Airplane altimeters are of the aneroid type.

The aneroid barometer consists of a box of thin, flexible metal with the air inside partially exhausted.

One side of the vacuum box is attached to a spring. When atmospheric pressure increases the box tends to collapse; when pressure decreases the sides of the box spring outward. This slight movement is magnified by a series of levers as shown in the accompanying diagram. A *barograph* is an aneroid barometer linked to a pen that traces changes in pressure on a moving record sheet.

A variation of the aneroid barometer was invented by Eugène Bourdon, French engineer and originator of the Bourdon pressure gauge used with steam boilers. A flattened tube of metal is evacuated and bent into a circle. The circle tends to close up with greater pressure and open out with lesser pressure. This movement is transmitted to a dial as in the aneroid instrument.

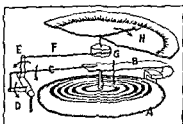
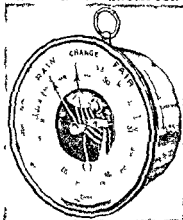
For use as a weather instrument a barometer must be set to give corrected readings. Variations due to altitude must be disregarded so an observer at a mountain station sets his instrument to give readings corrected for altitude. This means that the barometer registers pressures as greater than they actually are. He also takes account of the force of gravity at his particular latitude and may correct for the ex-

pansion and contraction of the barometer due to temperature changes. Anyone with a new barometer should call the local weather bureau for a corrected reading in order to set the instrument properly.

Barometer readings are usually reported in inches or millimeters of mercury. *Millibars* are also used. A millibar is 1/1,000 of a bar, which is normal sea-level pressure at 32° F. in latitude 45°. One bar is equal to 29.5306 inches of mercury.

BARRACUDA One of the fiercest of fishes is the barracuda found in the warmer parts of the Atlantic and the Pacific. It has the savage appearance of the fresh water pike—a narrow muscular body, a long cruel mouth with undershot jaw and yellowish green eyes. It is however no relative of the pike and differs from it in having two fins on the back. Specimens

AN ANEROID BAROMETER



The dark band of an aneroid barometer indicates pressures and the other can be set over it to note change from day to day. The diagram shows how an aneroid works when pressure is rising. The top of the vacuum box (A) is forced down and pulls down the spring (B). This moves the linkage (C, D, E) and pulls a chain (F) wound on a drum (G) thus turning the band (H) to the right. When pressure falls these motions are reversed.

more than six feet long have been caught, but the average is from three to four feet.

The barracuda ranges far in search of food. When it finds a school of fish, it circles about them until they huddle together in fear, then dives into their midst, biting and slashing with its sawlike teeth. Barracudas will strike almost any moving object and are easily caught by trolling. Swimmers have been severely, even fatally, bitten by large barracudas.

Barracudas belong to the family *Sphyrenidae*. About 20 species are known. Scientific name of the great barracuda of the West Indies and Florida, *Sphyrena barracuda*; of the most important California species, *Sphyrena argentea*; of the European barracuda, *Sphyrena sphyrena*. The California species are widely used as food. The so-called Australian barracuda, or barracouta, another valuable food fish, belongs to a different family.

BARRIE, SIR JAMES MATTHEW (1860-1937). From the bleak Antarctic a dying explorer, Robert Falcon Scott, penned his last letter, bidding farewell to his friend Barrie, the famous author. Ten years later, Barrie, in an address at St. Andrews University, quoted part of this letter, to illustrate his theme of "Courage." But with characteristic diffidence Barrie did not reveal that he had financed the expedition and, at its tragic end, had assumed the care of Scott's widow and son. Only a few intimate friends knew the great-hearted generosity of this shy, reserved Scotsman; but countless readers have been delighted by the charm, tenderness, and quiet humor that he gave to the whole world in his stories and plays.

Barrie was born May 9, 1860, at Kirriemuir, Scotland. His father, David Barrie, was a weaver. Though the family was poor, Barrie was educated at Dumfries Academy and Edinburgh University. After college he wrote for several English newspapers, and in 1885 went to London. There he first won recognition by sketches of his native village, which he called "Thrums." His success with these stories in Scottish dialect inspired other writers in the same field, often called the "Kailyard School" of literature.

At this time Barrie wrote his greatest work, 'Margaret Ogilvy', a tribute to his mother. In this story of his early life with her, Barrie reveals himself clearly and without reticence. After 1900, most of his works were plays, which were acted by some of the greatest actresses of England and the United States.

Barrie had an amazing understanding of the feminine mind, whether of high-born ladies or kitchen drudges; but most amazing is the fact, as he himself

tells us, that all his heroines were drawn from his mother.

Best known of all Barrie's creations is Peter Pan, the little boy who wouldn't grow up, who lived in a fascinating world full of Indians, pirates, and fairies. The play, 'Peter Pan', grew out of stories (based on

part of Barrie's novel 'The Little White Bird') which he told for some young friends. It was an immediate and lasting success. First presented in 1904, it has been played in London every year since. Its mixture of fantasy, humor, and exciting adventure appeals both to children and to adults. And in book form 'Peter Pan' reaches an even greater audience. Barrie retold the play in narrative form as 'Peter and Wendy'; and parts of 'The Little White Bird' he made into a separate work called 'Peter Pan in Kensington Gardens'. Barrie wanted his creation to delight and benefit children as much as possible, and so he gave a statue of Peter to be placed in Kensington Gardens, and donated all rights in the play to a hospital for sick children in London.

Barrie and his wife (Mary Ansell, whom he married in 1894) had no children, but he adopted the Davies boys, who had been his first audience for the story of 'Peter Pan'.

In later life Barrie wrote little, but many honors came to him. He was made a baronet in 1913, and in 1922 he received the Order of Merit.

Representative Works

Novels and stories—'Auld Licht Idylls' (1888); 'A Window in Thrums' (1889); 'The Little Minister' (1891); 'Margaret Ogilvy', 'Sentimental Tommy' (1896); 'Tommy and Grizel' (1900); 'The Little White Bird' (1902); 'Peter Pan in Kensington Gardens' (1906); 'Peter and Wendy' (1911); 'Farewell, Miss Julie Logan' (1932).

Plays—'The Professor's Love Story' (1895); 'Quality Street', 'The Admirable Crichton' (1902); 'Peter Pan' (1904); 'What Every Woman Knows' (1908); 'A Kiss for Cinderella' (1916); 'Dear Brutus' (1917); 'Mary Rose' (1920); 'Shall We Join the Ladies?' (1922); 'The Boy David' (1936).

BARRY, JOHN (1745?-1803). This naval officer, sometimes called "the father of the American navy," was one of the men to whom the United States owes its beginnings as a world power on the sea. He was born in Wexford County, Ireland. So little is known of his childhood that historians disagree about the year of his birth. He went to sea as a boy and, about 1760, made his home in Philadelphia. There he grew wealthy as master and owner of a ship.

Early in the Revolutionary War (December 1775) Barry received the first captain's commission issued under authority of the Continental Congress, and was made commander of the brig *Lexington*. He

PETER PAN



This bronze statue of Peter Pan, by Sir George Frampton, stands in Kensington Gardens, London.

was the first naval officer to capture a British warship in actual battle when the British tender *Edward* yielded to the *Lexington* (April 1776). In the winter of 1776-77 he led a troop of volunteers on land in the Trenton and Princeton campaigns. In the spring of 1777 his exploit on the lower Delaware River thrilled the Americans and gave them new heart. With a small force of rowboats he outmaneuvered the British and captured some of their transport cutting off from their army large quantities of supplies. This brought him warm praise from General Washington. During the closing years of the war Barry won fame as commander of the *Alliance* a ship of 32 guns. With the *Alliance* in 1781 he captured the British vessels *Trepasser* and *Atalanta*. He was severely wounded in the battle.

Barry's record brought great prestige and he was named senior captain when the navy was reorganized in 1794. This was then the highest post in the navy. He was popularly called Commodore. He was made commander of the flagship *United States* and placed in charge of the naval forces in the West Indies. He died in Philadelphia Sept. 13 1803.

BARTHOLDI FRÉDÉRIC AUGUSTE (1834-1904). From the decks of ships entering New York harbor home-coming Americans and foreigners eagerly watch for the Statue of Liberty. This colossal figure whose

NAVAL HERO



John Barry as ved w d d at action dur g the Revolut on

right hand holds a great torch high over Bedloe's Island was the work of the French sculptor Frédéric Auguste Bartholdi a native of Colmar Alsace.

As a young man Bartholdi began the study of painting but soon turned to sculpture. Much of his earlier work consisted of portrait busts. After serving as a soldier under Garibaldi in the Franco-Prussian War he worked on patriotic and symbolic statues. Some of them were of gigantic size. His *Switzerland Assailing the Sorrows of Strasburg* was presented by France to Switzerland in gratitude for its sympathy during the war. The *Lion of Belfort* considered Bartholdi's masterpiece commemorates the Belfort siege in 1871. It is carved from the red rock of a hill that overlooks the city.

To Bartholdi America was the great pioneer who had shown the whole world the pathway to liberty. The story of how France largely through the influence of Lafayette helped the American colonies to gain their freedom inspired some of his best sculptures. One of them, *Lafayette Arriving in America* was presented to New York City by French residents and set up in Union Square in 1876. Another Washington and Lafayette stands in Paris.

His *Liberty Enlightening the World* symbolizes the ideals of both nations. The statue was a gift from

FRÉDÉRIC BARTHOLDI



The Statue of Liberty s the work of th s French sculptor

the people of France to the people of the United States. The original plan was to present it on the 100th anniversary of the signing of the Declaration of Independence but the dedication was delayed until 1886. (See *Liberty Statue* of)

BARTON CLARA (1871-1912)

Spirited impetuous Clara Barton was the founder of the American branch of the Red Cross. Her whole life was a crusade to relieve human suffering. Born on a farm near Oxford Mass. she was christened Clarissa Harlowe Barton. Though always frail and small she had amazing courage and perseverance. When she was only five a brother taught her to ride half broken colts. At 11 she nursed an invalid brother attending him until his recovery two years later.

BARTHOLDI'S LION OF BELFORT



This sculpture is considered Bartholdi's greatest work. The statue honors the men of Belfort France who held off the invading Germans for three months during the Franco-Prussian War. It is carved from red rock and overlooks the city.

As a child she had no close playmates. Her solitary life helped to make her shy. To correct her timidity, her mother gave her much responsibility. At 15, with her mother's help, Clara Barton became a teacher. She conquered her shyness and taught for 18 years. In Bordentown, N. J., she promoted a free school for the poor.

RED CROSS FOUNDER



Clara Barton's whole life was devoted to helping others.

In 1854 she suffered the first of many periods of nervous exhaustion brought on by her strenuous work. Later that year she was appointed a clerk in the Patent Office at Washington, D. C. At the outbreak of the Civil War, she learned that much suffering at the front was caused by the scarcity of supplies. Singlehanded, she organized supply depots for the soldiers. Later in the war she served as a nurse and, in 1864, was appointed a superintendent of nurses. She often served near the line of fire and many called her "the Angel of the Battlefield." After the war, for four years, she headed the government search for missing soldiers.

While in Europe for her health, she did relief work in the Franco-Prussian War and studied the action of the Red Cross. On her return home in 1872 she campaigned to organize a branch in the United States. Other people had failed in a similar effort, but Clara Barton succeeded in 1881 (see Red Cross Societies). For 23 years she directed Red Cross work in every great disaster. But her quick, commanding temperament prevented her from working well with associates and she resigned in 1904. In addition to her humanitarian work, she wrote and lectured extensively.

BARUCH, BERNARD MANNES (born 1870). Although he never ran for political office, Bernard M. Baruch held important posts in the United States government. As a young man he made a fortune buying and selling stocks. Later he developed industries. He became noted for his financial skill, and six different presidents of the United States called upon him to solve difficult economic problems.

Baruch was born on Aug. 19, 1870, in Camden, S. C. He was of Jewish descent. His father, Simon Baruch, came from East Prussia and had served as surgeon in the Confederate army. His mother's family had come from Portugal before the American Revolution. The Baruchs moved to New York City in 1881. Young Baruch went to City College. Lean, hardy and over six feet three inches tall, Baruch became a skilled boxer and developed a life-long interest in sports.

While at college he received an appointment to West Point. He was rejected because of defective hearing, the result of an injury which he received during a college baseball game. He was graduated from City College at 19.

In 1890 Baruch took a job as an office boy in a small New York brokerage house. By 1897 he owned a one-eighth interest in the firm. This same year Baruch speculated in stock and made his first large personal profit. He then had enough money to buy a seat on the New York Stock Exchange. Six years later he was a multi-millionaire. In 1903 Baruch opened his own office. He refused to join any of the large New York financial houses and was often called the "lone wolf of Wall Street."

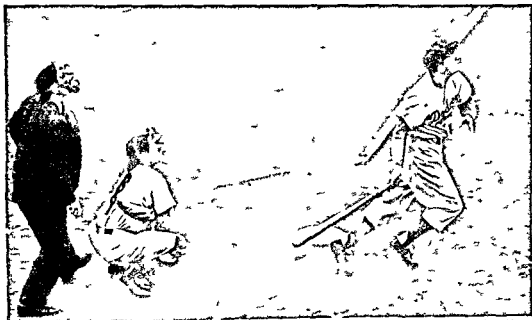
Politically Baruch was an ardent Democrat. During the 1912 presidential campaign he met Woodrow Wilson, who became Baruch's idol. In 1916 Wilson appointed Baruch a member of the advisory commission of the Council of National Defense and Baruch resigned from the Stock Exchange. Two years later Wilson made him chairman of the War Industries Board. While this organization lasted, Baruch was virtually economic dictator of the United States. After the war, Wilson offered him the post of secretary of the treasury. Baruch refused. Wilson then sent him to the Paris Peace Conference as a delegate.

PARK BENCH STATESMAN



One of Bernard M. Baruch's favorite conference spots was a bench in Lafayette Park in Washington, D. C., within sight of the White House. Here he chats with his son, Comdr. Bernard M. Baruch, Jr.

After Wilson's death, Baruch continued to act as unofficial presidential advisor, regardless of the party in power. He wanted the United States to stay prepared against future aggression. During the 1920's his advice often went unheeded. With the rise of Hitler, government officials began to respect Baruch's suggestions. Among the wartime measures he advised were: a pay-as-you-go tax plan, industrial priorities, rent ceilings, and a synthetic rubber program. In 1946 President Truman appointed Baruch to the Atomic Energy Commission (see United Nations).



One of the greatest thrills in baseball is hitting a mighty home run. In this world series game the batter catcher

and umpire watch the flight of a batted ball. It has been hit so well as to be an unmistakable home run from the start.

The NATIONAL GAME of the UNITED STATES

BASEBALL Play ball. For more than one hundred years this cry has signaled the start of a baseball game, the national sport of the United States. From spring until early fall baseball is played in every state in the Union. Playing fields vary from small neighborhood sandlots to well maintained spacious stadiums specially built for professional teams.

Baseball is a sport of tremendous popularity. Every year 35 to 40 million spectators attend games played by professional teams. An additional 15 to 20 million watch games played by organized teams of semiprofessionals and amateurs. Radio and television stations carry play by play accounts of games, newspapers report results and records in great detail and in and out of season baseball fans everywhere discuss the relative merits of teams and players.

This great popularity makes baseball a big business as well as a sport. The two major leagues alone receive about 35 million dollars a year from admissions, hot dog sales and other concessions and broadcast rights. Expenses however are also high. The average player payroll of a major league team is more than \$400,000 a year. Outstanding prospects have received \$100,000 or more to join a team and some of the greatest stars of the game are paid about as much in salary as the president of the United States.

The enthusiasm for baseball in the United States has gradually spread to other countries. Several minor leagues have teams representing cities in Canada, Cuba and Mexico. After the close of the season in the United States many winter leagues flourish in

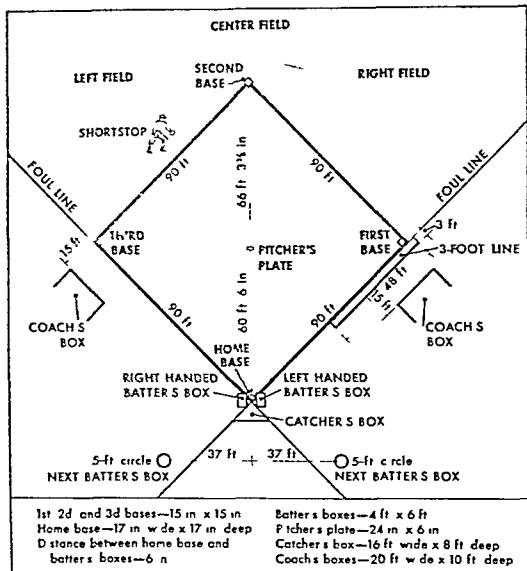
Latin American countries. Baseball has also become popular in Japan, the Philippines and elsewhere.

Major and Minor Leagues

The goal of every player and the center of baseball interest are the two major or big leagues—the National and the American. Each major league team plays a 154-game schedule to determine the league champion. A team's standing depends on its percentage, which is determined by the number of games the team has won divided by the number it has played. For example, if a team has won 12 games out of 18, its percentage is 666. The team with the highest percentage in each league at the end of the season is the pennant winner. Each year the two league champions meet in a world series held early in October. The team that wins four games is the world champion.

Since 1933 the two major leagues have played an all-star game in July. This contest is not counted as part of the regular league competition. It is a game between the best American League and National League players. The starting line-up except

| THE MAJOR LEAGUE TEAMS | | | |
|------------------------|-----------|-----------------|-----------|
| NATIONAL LEAGUE | | AMERICAN LEAGUE | |
| CLUB | NICKNAME | CLUB | NICKNAME |
| Boston | Dodgers | Baltimore | Orioles |
| Chicago | Cubs | Boston | Red Sox |
| Cincinnati | Redlegs | Chicago | White Sox |
| Milwaukee | Braves | Cleveland | Indians |
| New York | Giants | Detroit | Tigers |
| Philadelphia | Phillies | Kansas City | Athletics |
| Pittsburgh | Pirates | New York | Yankees |
| St. Louis | Cardinals | Washington | Senators |



This is an official playing field. One defensive player guards each base and each outfield area. The shortstop takes the position shown. White surfaces within the field are "skinned" (bare ground). The remaining surface is grass. Home base is a five-sided figure, the catcher's box is triangular.

for pitchers is selected by a vote of the fans. Profits from the game go into a player pension fund.

In addition to the major leagues, there are minor leagues which have teams in hundreds of American cities. The highest classification in the minors is *Open*, which the Pacific Coast League assumed in 1952. In quality of play the minor leagues below *Open* are classed as AAA, AA, A, B, C, and D. Each league receives its classification according to the total population of its represented cities.

The major leagues are governed by an executive council—the high commissioner, the two league presi-

dents, and one club president and one player from each league. The minor leagues are ruled by the National Association of Professional Baseball Leagues. These two groups make up "organized baseball."

Major League Managers and Players

In charge of each team, and responsible for playing strategy, is the manager. Two of the greatest managers, John J. (Muggsy) McGraw of the New York Giants and Cornelius McGillicuddy (Connie Mack) of the Philadelphia Athletics, managed from the players' bench, or *dugout*. McGraw's successor, Bill Terry, and Detroit's Mickey Cochrane were among several successful player-managers.

Each major league team is limited to 25 players. A player is bound to his team by a contract, usually renewed annually. The *reserve clause* in this contract forbids a player to play with any other club unless he has been released. Players who break this contract may be suspended from the game. A star player may be sold for as much as \$250,000, but such a high-priced sale is rare. More common is the trading of players among clubs to bolster team weakness.

Major league players receive a minimum annual salary of \$6,000. Star players may receive \$80,000 or more in base salary. They may also be paid bonuses based on attendance. Members of the top four teams in each league share in the gate receipts from the first four world series games. The players' pool for the winning team is a minimum of \$150,000, the losing team shares at least \$100,000. Six weeks are spent in spring training camps in the South, in Arizona, in California, or in Cuba.

Both major leagues have a pension plan for retired players. A player may receive up to \$100 a month, depending upon the time he spent in the major leagues. A player becomes eligible for a pension at the age of 50.

Opportunities in Professional Baseball

Each team has several *scouts* who watch games in minor leagues, college campuses, and amateur play-

THE FIRST FIVE PLAYERS SELECTED FOR



Christy Mathewson pitched for the New York Giants from 1900 to 1916. He starred in the world series of 1905.



Honus Wagner of Pittsburgh (1900-17) was the greatest shortstop, at bat and in the field, in the history of baseball.



Walter Johnson, the "Big Train," won 414 games for Washington during an amazing major league career (1907-27).

grounds searching for baseball talent. Bob Feller, one of baseball's greatest pitchers, was discovered playing on a high school team. At the age of 17 he received an opportunity to play with the Cleveland Indians and he made good.

Most players however rise to the majors by way of the minor leagues. They may be purchased from minor league teams or obtained in the annual player draft. Under the draft system each major league team is permitted to select for a set percentage one player from each of the top league clubs through Class A and an unlimited number of players from the B, C and D league clubs.

Some major league clubs have their own minor league teams. These minor clubs are called *farms*. When a player on a farm team has developed sufficiently he is brought up to play for the parent club.

Major league players who slump because of poor performance or age are sent back to the minors. Before a player can leave the majors however he must be refused (waived) by every major league club. Sometimes a veteran player who is not doing well may improve when traded to another club. For example in 1914 the Boston Braves acquired several veterans who were considered through. With these veterans the team swept from last to first place and beat the Philadelphia Athletics in the world series with four straight victories. Generally however players sold for the waiver price (\$10,000) do not become stars.

The Field and Equipment

A baseball field is laid out in the form of a square called a *diamond*. The nine players are pitcher (the *batter*), first baseman, second baseman, third baseman, shortstop (the *infield*), left fielder, center fielder, and right fielder (the *outfield*). The catcher stands behind home plate and the second baseman occupies the area to the right of second base. The other players cover the positions indicated in the diagram on the preceding page.

BASEBALL'S HALL OF FAME



Ty Cobb, an outfielder, played with Detroit (1905-20). He was a deadly hitter and daring base runner.



Babe Ruth, outfielder for the New York Yankees (1920-34), was the greatest home-run hitter of all time.

The ball must be between 9 and 9 1/4 inches around, and must weigh 5 to 5 1/4 ounces. It is made of a cork center inside layers of rubber and woolen yarn and is covered with hand-stitched horsehide. Bats are limited to 2 1/2 inches in diameter and 42 inches in length. The catcher may wear a mitt of any size or weight. The first baseman wears a mitt not more than 12 inches long or more than 8 inches wide. All the other players wear gloves of not more than 10 ounces or more than 14 inches around the palm.

Playing the Game

The visiting team goes up to bat first. The manager decides in advance the order in which the players will bat, and they (or their substitutes) must follow that order throughout the game. Usually the heavy hitters bat at the head and middle of the line up.

A run is scored every time a player has made a complete circuit of the three bases and has returned to home plate. To get on base in position to make a run, the batter tries to hit the pitched ball anywhere in the foul lines in such a way that no opposing player can catch the ball before it touches the ground. The batter (now called the *runner*) must then reach first base at least before the ball is recovered and thrown or carried to that base ahead of him. A ball batted safely in this way is counted as a *hit*.

A ball hit far enough to permit the batter to reach first base safely is called a *single*, a hit good for two bases is called a *double*, or a *two-bagger*, one good for three bases is called a *triple* or a *three-bagger*. When a fair ball is hit out of the playing field the hit is good for four bases or a *home run*.

If the first batter angles and the second batter does likewise, the first batter is advanced to second base. Then if the third batter should hit a home run, his teammates on bases will score ahead of him for a total of three runs.

The aim of the team in the field is of course to keep the batters from scoring. The pitcher can *strike out*

the batter by throwing three *strikes*. A strike is counted when the batter swings at the ball and misses or when the batter fails to swing at a ball that passes over the plate above his knees and no higher than his armpits. A ball knocked into foul territory counts as a strike except when a batter already has two strikes against him, in which case the *foul ball* does not count for anything. A *foul tip* (ball glancing slightly off bat) when caught by the catcher always counts as a strike.

If the pitcher fails to throw the ball far across the plate and the batter lets it go by, it counts against the pitcher as a *ball*. If the pitcher throws four balls to any one batter, the batter is given a *walk* to first base that is he goes to first without having to hit and run. The batter also gets a free pass to first if a pitched ball hits any part of his body provided he made an effort to dodge the pitch.

The real work of the players in the field begins when the batter hits a fair ball. If it is a *fly* or a *liner*, the fielders try to catch it before it falls to the ground. A batted ball, fairly caught in the air (either fair or foul), puts the batter *out*. If the batted ball is a *grounder* to the infield the defensive players try to field it (that is scoop it up) and throw it to first base ahead of the runner for an out.

A base runner may be put out by being tagged with the ball while off base, as in attempting to *steal* the base ahead. He may also be *forced out* by throwing the ball to the base ahead. For example, a base runner on first base is forced to second when the next batter becomes a base runner by hitting the ball. Usually the defensive team tries to put out the man nearest home and therefore most likely to score a run.

When three men have been declared out, the batting team is retired. It then takes the field and the other team takes its turn at bat. When both teams have had three men put out, the *inning* is over.

Nine innings make a normal game unless the home team is ahead at the end of $8\frac{1}{2}$ innings. In that case the game is complete. If the score is tied at the end of the ninth inning, the teams play additional innings until one side wins or until the game is *called* because of darkness or for some other reason. Brooklyn and Boston in the National League played 26 innings

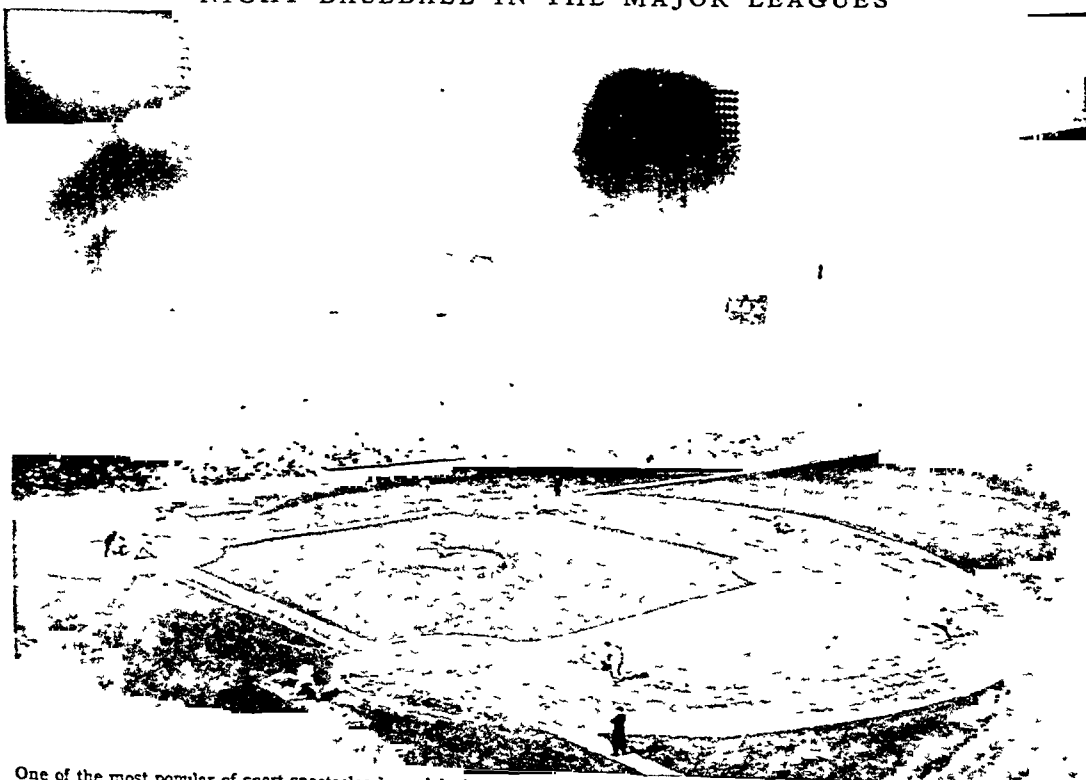
to a 1 to 1 tie, May 1, 1920, for the longest major league game on record. Sometimes play is halted by rain, darkness, or some other cause before nine innings are completed. If five (four and one half, if the home team is ahead) or more innings have been played, the game is counted as official. If less than this amount has been played the game is canceled.

The Art of Pitching

The most important man on the defense is the pitcher. He has the job of making the opposing batter miss the ball or else hit it where it can be fielded by one of the members of the defensive team. A good pitcher has a fast ball, a curve ball, and a change of pace. He puzzles the batter by mixing up these pitches with baffling irregularity. Above all, he has *control*—the ability to throw the ball where he aims it.

The trick of throwing curves lies in the spinning motion given the ball as it leaves the pitcher's hand. The diagram on the opposite page shows why a ball curves. If a right-handed pitcher throws a ball that breaks toward a right-handed batter it is an *incurve*; if it breaks away from a right-handed batter it is an *outcurve*. Each of these basic types has several different forms—a sharply breaking incurve may be a *screuball*, an outcurve that breaks horizontally may be a *slider*. The break of a curve may vary from an inch to a foot or more.

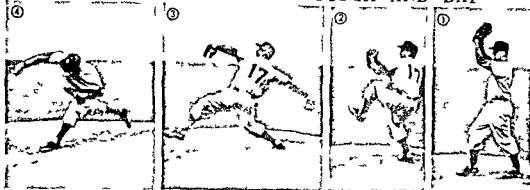
NIGHT BASEBALL IN THE MAJOR LEAGUES



One of the most popular of sport spectacles is a night baseball game. This field (Boston's Fenway Park) is illuminated by 200

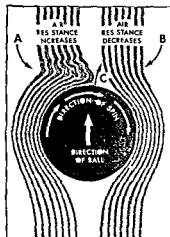
foot-candles of light, the equal of about 5,000 full moons. The first major league night game was played at Cincinnati in 1935.

HOW MAJOR LEAGUERS PITCH AND BAT



A smooth, natural delivery helps a pitcher's arm or control. 1. A right-handed pitcher places his right foot on the rubber. He begins his windup by stretching his arms above his head. 2. He then brings his arms down and kicks his left leg.

high. 3. Pivoting backward, he cocks his arm to throw. 4. As he whips his arm through the air, he pivots forward, stepping toward the batter with his left foot. The follow-through should leave him in a position to field any ball hit in his area.



This diagram shows why a ball curves. The pitcher spins the ball clockwise. On the left the friction on the ball's spinning surface works against the air. This piles up the air at A. On the right the friction works with the air, thinning it and decreasing resistance at B. The ball follows the path of least resistance and curves toward the batter at C and slides down (curve). A reverse spin makes an outcurve.



For a fast ball, grip with the fingers, snap the wrist forward and down so that the ball backs off the fingertips. This makes it hop.



For a curve ball, use the same hold as for a fast ball. To throw an outcurve, snap the wrist, spinning the ball with the first finger and thumb.



To throw a change of pace or slow ball, grip the ball tightly with fingers and palm. Lift the first two fingers slightly as the ball leaves the hand.



A good knuckle ball will drop sharply as it reaches the batter. Hold it as shown here. Release it with a stiff wrist, giving it no snap or spin.



A good hitter learns to swing only at pitches that are in the strike zone (shown above). This means watching the ball all the way from the pitcher to the plate.



To hit well, take a comfortable stance at the plate. Bend the body slightly from the waist. Step "into" the pitch, swinging the bat with a smooth, level motion.



The bunting stance should be taken only as the pitcher releases the ball. Hold the bat loosely. Do not push at the ball; let it hit the bat and bounce back.

EXCITING PLAYS ON BIG LEAGUE DIAMONDS



A catcher "guards" home plate by tagging out a base runner who has tried to score. The umpire's upraised thumb tells the runner "Out!"



The shortstop gets a *force out* on a runner at second base. A quick throw to first (picture at right) means a second out, or *double play*.



An infielder's chief job is to scoop up grounders and throw the ball to first base in time to put the batter out.



A throw to the first baseman retires a runner, perhaps completing the double play started in the picture at left.



Catching a runner in a "hotbox" is a thrilling play. Trapped between the third base and home this runner tries to avoid being tagged out.



A good outfielder begins his pursuit of a fly ball with the "crack of the bat." A misjudged fly is a sure hit.

FAMOUS INDIVIDUAL RECORDS FOR ONE SEASON*

| TYPE OF RECORD | RECORD | PLAYER | YEAR | TEAM |
|-----------------------------------|--------|------------------|------|---------------------|
| Highest batting average | .424 | Poppers Hornsby | 1924 | St. Louis Cardinals |
| Most home runs | 60 | Babe Ruth | 1927 | New York Yankees |
| Most hits | 257 | George Sisler | 1920 | St. Louis Browns |
| Most runs batted in | 190 | Hack Wilson | 1930 | Chicago Cubs |
| Most consecutive games hit safely | 56 | Joe DiMaggio | 1941 | New York Yankees |
| Most consecutive hits | 12 | Pinkey Higgins | 1935 | Boston Red Sox |
| Most stolen bases | 112 | Walter Dropo | 1952 | Detroit Tigers |
| Most games won by pitcher | 96 | Ty Cobb | 1915 | Detroit Tigers |
| Most strikes-outs by pitcher | 41 | Jack Chesbro | 1904 | New York Yankees |
| Most no-hit no-run games | 349 | Bob Feller | 1946 | Cleveland Indians |
| | 2 | John Vander Meer | 1938 | Cincinnati Reds |
| | 2 | Allie Reynolds | 1951 | New York Yankees |
| | 2 | Virgil Trucks | 1952 | Detroit Tigers |

*Records held only under present rules in effect after 1900

Perhaps the greatest pitcher in baseball was Walter Johnson. His lightninglike fast ball and superb control enabled him to strike out more men in 1 pitch more shutouts (no runs allowed) than any other pitcher in the history of the game.

Other great pitchers were Christy Mathewson, Grover Alexander, Cy Young, Lefty Grove, Carl Hubbell, Dizzy Dean and Bob Feller. A specially constructed apparatus once timed Feller's fast ball at 145 feet per second.

The Catcher and the Infielders

Next to the pitcher the most important man on the defensive team is the catcher. The catcher stands or crouches behind home plate garbed in a mask, chest protector, shin guards and a heavily padded glove. He catches all pitches that go by the batter field many pop fouls and backs up plays at first and third bases.

A good catcher knows the opposing batter's weaknesses and signals the pitcher as to what kind of a pitch to throw. Because he is in a position to see the entire playing field he often directs defensive strategy. Some great catchers include Ray Schalk, Mickey Cochrane, Roger Bresnahan, Gabby Hartnett and Bill Dickey.

It is the duty of the infielders—basemen and shortstop—to prevent batted balls from going into the outfield for base hits. They are also responsible for tagging out or forcing out runners. The shortstop often covers second base especially when the batter is left-handed.

Among the great infielders in baseball history are George Sisler, Lou Gehrig,

Bill Terry and Frank Chance at first base (see Gehrig); John Evers, Nap Lajoie, Eddie Collins, Rogers Hornsby and Frank Frisch at second; James C. Huns and Pie Traynor at third; and Honus Wagner, Hughie Jennings, Joe Tinker and Luke Appling at shortstop.

Slugging Outfielders and Watchful Umpires

The outfielders go after the long, high flies or the ground balls that are batted past the infield. An outfielder must protect a large area and have a good throwing arm to get the ball back into the infield. Usually outfielders are also a team's heaviest hitters. Among the greatest outfielders of all time

HOW TO READ A COMPLETE BOX SCORE

| STARS | AB | R | H | 2B | 3B | HR | TB | RBI | SH | SB | SO | PO | A | E |
|------------|-----------------------|---|---|----|----|----|----|-----|----|----|----|----|----|----|
| Mathewson | 4 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 3 | 1 |
| Moulton 3b | 3 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 2 | 1 | 0 |
| Young cf | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 3 | 0 | 0 |
| Murphy 1b | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 0 | 0 |
| Bloom rf | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 0 | 1 |
| Peayolds H | 4 | 0 | 3 | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| Falk 2b | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 0 |
| Shaffer c | 4 | 1 | 1 | 0 | 0 | 1 | 4 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| Ring p | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 |
| Totals | 32 | 1 | 7 | 2 | 0 | 1 | 12 | 1 | 1 | 0 | 8 | 24 | 7 | 2 |
| ROBINS | AB | R | H | 2B | 3B | HR | TB | RBI | SH | SB | SO | PO | A | E |
| Charles H | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| White s | 4 | 1 | 2 | 0 | 0 | 1 | 5 | 1 | 0 | 0 | 0 | 1 | 2 | 0 |
| Jones 1b | 4 | 1 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 12 | 2 | 0 |
| Fremont rf | 2 | 2 | 2 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| Booth cf | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Wheeler c | 3 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 9 | 1 |
| Grove 2b | 3 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 3 | 4 | 0 |
| Wilson 3b | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| Brown p | 4 | 0 | 2 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 2 |
| Totals | 31 | 6 | 9 | 1 | 0 | 1 | 13 | 5 | 2 | 0 | 4 | 5 | 27 | 12 |
| STARS | 0 0 1 0 0 0 0 0 0 0=1 | | | | | | | | | | | | | |
| ROBINS | 0 0 0 0 1 1 0 4 1=6 | | | | | | | | | | | | | |

Earned runs—Robins 4 Stars 1. Left on bases—Robins 7 Stars 7. Dou let play—White to Grove to Jones. Bases on balls—off Brown 4 off Ring 1. Struck out—by Brown 5 by Ring 3. Hit batsman—by Ring 1 (Fremont). Winning pitcher—Brown. Losing pitcher—Ring. Umpires—Kennedy at plate, Gehrig at first base, Monahan at second base, Summerville at third base. Time—2 hours 40 minutes.

This is the complete box score of a nine-inning game. The meaning of the initials heading each column is as follows: AB at bat, R runs, H hits, 2B two-base hits, 3B three-base hits, HR home runs, TB total bases earned by player's hits, RBI runs batted in, SH sacrifice hits, SB stolen bases, BB bases on balls, SO strike-outs, PO put outs, A assists in making put-outs, E errors. The two lines of figures below the box score show the number of runs made in each inning and the final score.

are Babe Ruth, Ty Cobb, Tris Speaker, Joe Di Maggio, and Ted Williams (*see* Ruth, George).

All baseball games must have at least one umpire to call balls and strikes and to rule on the various plays. Major league games usually have four umpires, one at each base. World series games use six umpires, the two extra men stationed along each foul line.

Record Keeping and Hall of Fame

Accounts of baseball games are given in the form of *box scores*. This summary was invented by Henry Chadwick, pioneer baseball writer. In professional games the box score is kept by an official scorer. Detailed records of each professional player are maintained by his club and by local newspapers.

Chief items recorded are a player's batting average (number of hits divided by number of times at bat) and his fielding average (total of put-outs and assists divided by total of put-outs, assists, and errors). Important pitching records are the number of games won and lost and the earned-run average (total of earned runs allowed, divided by number of innings pitched, multiplied by nine).

The game's greatest figures are recognized in the National Baseball Hall of Fame and Museum at Cooperstown, N. Y. The first members of the Hall of Fame were chosen in 1936. New additions are proposed each year. The players prominent within the last 25 years are chosen by the Baseball Writers Association; those who won fame earlier are selected by a special committee. (For table of members of Baseball Hall of Fame, *see* Baseball in FACT-INDEX.)

The Youngest Stars of the Game

An outstanding feature of baseball during the 1950's was the rapid growth of leagues organized for young players. Within a few years these leagues spread

A LITTLE LEAGUER SCORES A RUN



The umpire's palm-down signal shows that the base runner has successfully escaped the catcher's tag and is safely home scoring a run. To avoid injury Little Leaguers wear rubber cleats instead of steel spikes.

WHO INVENTED BASEBALL?



BASE-BALL.

The "baseball" game pictured at the left is illustrated in the 1787 edition of 'A Little Pretty Pocket-Book'. It shows a batter about to hit the ball with his hand. The bases are marked by posts. Abner Doubleday (right) is supposed to have invented baseball some 50 years later.



across the nation and to Canada and Latin America. The youngest stars perform in the Little League, founded by Carl Stolz in 1939 at Williamsport, Pa. Competition is limited to boys aged 8 to 12. Six-inning games are played on a diamond two thirds regulation size. Boys aged 13 and 14 are eligible to play in the PONY (Protect Our Nation's Youth) League, organized on a national scale in 1952 at Washington, Pa. In this league base lines are 75 feet long and the pitching distance is 52 feet.

Regulation baseball is played in the Little-Bigger League, organized in 1951 and renamed the Babe Ruth League two years later. This league is limited to boys between the ages of 13 and 15.

More than half the major league players of today began their baseball careers in American Legion Junior Baseball, founded in 1926. In this competition, players 16 years old or less follow regular baseball rules. About 16,000 teams participate in annual play-offs, with 12 district winners meeting for the national championship.

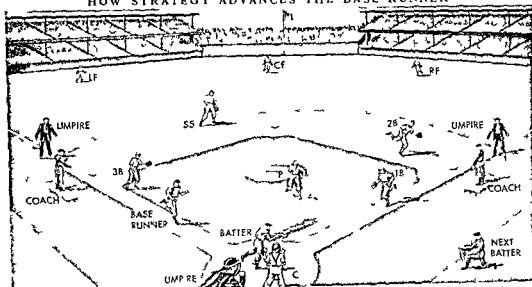
Baseball games between college teams have been played regularly since the Civil War. An annual tournament to determine the national championship college team was first played in 1947.

Another opportunity for play is the National Baseball Congress, founded in 1934. The players are semi-professional; that is, they work at regular jobs and play baseball as a sideline. Each year semipro teams compete in district, state, and regional tournaments. The regional champions then meet for the national semipro championship. A Sandlot Hall of Fame for semipro players who graduated to the major leagues was installed at Cooperstown, N. Y., 1952.

The Question of Baseball's Origin

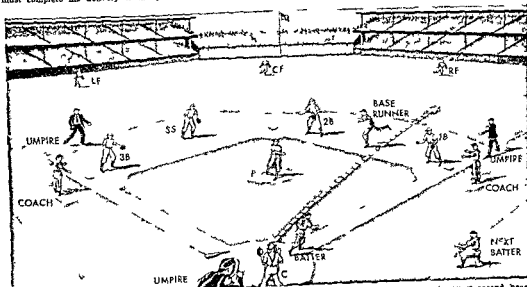
There has been much speculation about the origin of baseball. In 1907 a special commission decided that the modern game was invented by Abner Doubleday, a West Point cadet, at Cooperstown, N. Y., in 1839. One hundred years later the National Baseball Museum was opened at Cooperstown to honor Doubleday. Many historians, however, disagree about baseball's origin. They say that baseball comes from bat-and-ball games of ancient times and that Doubleday had little or nothing to do with its development.

HOW STRATEGY ADVANCES THE BASE RUNNER



On a squeeze play the runner on third starts for home as the pitcher winds up. Too late to stop his windup the pitcher must complete his delivery to the plate. The batter bunts

the ball toward first giving the base runner time to score from third. If the runner scores and the batter is thrown out at first base then the batter is credited with a sacrifice hit.



On a hit and run play the runner on first starts for second as the pitcher delivers the ball. Because this batter is right-handed the shortstop must protect the left side of the infield.

As the second baseman moves over to cover second base the batter then hits the ball safely through the gap left by the second baseman. The runner will probably reach third.

It is a matter of record that in the 1700's English boys played a game they called baseball. Players hit a ball and ran around posts or bases. Americans have played a kind of baseball since about 1800. At first the American game had different rules and different names in various parts of the country—town ball, rounders or one-o-cat. Youngsters today still play some of these simplified forms of the game.

Baseball did not receive a standard set of rules until 1845 when Alexander Cartwright organized the Knickerbocker Baseball Club of New York. Cartwright's rules for this team were widely adopted and they formed the basis of the modern game—a team had nine players, the game consisted of nine innings, it was played on a "diamond" infield with the bases 90 feet apart. Interest in the game grew rapidly.

In 1858, 25 amateur teams formed the National Association of Baseball Players. By 1867 more than 200 teams belonged to this association.

The Modern Game Begins

In 1869 the Cincinnati Red Stockings began to pay baseball players. They played a schedule of 57 games that year without meeting defeat. Their games attracted such large crowds that the success of professional baseball was assured. In 1871 ten clubs formed the National Association of Professional Baseball Players. Five years later the present National League was organized, chiefly by William Hulbert and Albert Spalding. The American League was organized in 1900 under the direction of Ban Johnson and played its first season the following year.

Baseball was shaken by scandal in 1919 when eight members of the Chicago White Sox accepted bribes to

"throw" the world series to Cincinnati. Two years later, Kenesaw M. Landis, a federal judge, became the first baseball commissioner. He assumed absolute authority over all phases of the game. Landis died in 1944 and was succeeded by Albert (Happy) Chandler, a former United States senator from Kentucky. In 1951 Chandler was replaced by Ford Frick, then president of the National League.

From 1949 through 1953 the New York Yankees set an all-time record by winning five consecutive pennants and world series. In 1953 the Braves team in the National League was transferred from Boston to Milwaukee, the first major league team transfer in 50 years. The following season the St. Louis Browns were moved to Baltimore and renamed the Orioles. (For a table of major league pennant and world series winners, see Baseball in the FACT-INDEX.)

Softball—Baseball's Younger Brother

FOR MANY years modified forms of baseball have been played in gymnasiums and on small outdoor fields. In these games a ball larger and softer than a regulation baseball was used. These contests were called by many different names, such as indoor baseball, kitten ball, and diamond ball, depending upon the locality and the somewhat indefinite rules that were followed. These various offshoots of baseball have now been merged into the nationally recognized game of softball.

The Amateur Softball Association of America was formed in 1933. Local leagues were organized and a joint rules committee representing the entire country drew up and published official playing rules.

Softball differs from baseball on the following principal points:

Base distances: Sixty feet between bases.

Pitching distance: The distance from the pitcher's box to the farthest point on the home plate is 46 feet.

Bat: The bat must not be more than 34 inches long or more than 2½ inches in diameter.

Ball: The ball must be between 11½ and 12½ inches in circumference and between 6 and 6½ ounces in weight.

Pitching: Underhand pitching only is permitted.

Innings: A regulation game is seven innings.

Base running: A runner must remain in actual contact with his base until the ball has left the hand of the pitcher.

Running home: No run shall be scored on any play in which the man on third is called out for leaving his base before a pitched ball has left the pitcher's hand.

Softball now has more players than any other American team game. Virtually all schools and public playgrounds have one or more softball fields. The game is fast and offers opportunities for developing skill. A good softball pitcher can throw curves with amazing speed and accuracy.

A variation called *slow pitching softball* is played with a 16-inch ball. In this game the base lines are 45 feet long and the pitching distance is 35 feet. The ball must be pitched at moderate speed and runners may lead off the bases. A tenth player, the "short fielder," occupies a position back of second base.

Softball has also become a popular game for women. Some teams play on a 45-foot diamond, pitching a 12-inch ball a distance of 35 feet. Others use a smaller ball that may be pitched overhand as well as underhand. For this game the pitching distance is 50 feet and the base lines are 72 feet long. The remaining rules are the same as those for baseball.

Books about Baseball and Softball

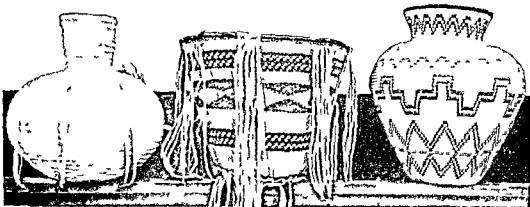
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A SAFE SLIDE IN ANY LEAGUE



A base runner slides safely past the baseman's effort to tag her. These girls play with a 10½-inch softball under modified baseball rules. Organized into a league of eight Midwest cities, teams play a regular schedule of more than 100 games.

MAKING BASKETS THAT HOLD WATER



Basketmaking has long been a fine art among the Apache Indians in the southwestern part of the United States. The three baskets shown here have been made watertight by coating the inside

with pitch. Colored baskets are made by using different kinds of material or by coating the outside with earth. Thongs of leather or plaited hair are often used for carrying the basket

BASKET The first basketmakers were probably birds. Their instinct taught them to weave the materials provided by nature into cozy nests. Men may have learned from them or may have been guided by instinct to make baskets by intertwining branches and twigs, stems and leaves, the flexible inner bark of trees and tough grasses.

Men even used the art of basketry to build homes. Rude huts fashioned in this way were among the earliest forms of shelter (for picture see Shelter). At a later date, but still thousands of years ago, men learned to weave materials into useful and beautiful

vessels for storing and carrying food and for many other purposes.

Basketmaking an Ancient Art

Baskets made 6000 years ago have been dug up from the dry sands of Egypt. When the Romans visited Britain in the first century before Christ, they found the inhabitants already very handy in the making of baskets of willows or osiers, much like those still made today. It is from these early Celtic inhabitants of Britain that the English word basket is derived.

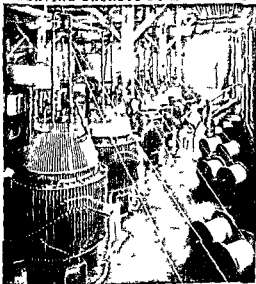
Basketmaking has been found among all primitive peoples and is one of the oldest of arts. As the earliest form of weaving, it may be regarded as the parent of clothmaking and all other textile industries. It is also related to pottery making for the first clay vessels are believed to have been made by smearing clay on baskets and then baking them in a fire.

Indians Had Many Uses for Baskets

Among the American Indians, especially the Western tribes, the art of basket weaving reached its highest development and was of the greatest importance. The newborn baby was placed in a cradle woven like a basket, and baskets were used in the burial of the dead. Baskets were used in many domestic tasks, even in carrying water. Some of the watertight baskets were coated with gum, others were so tightly woven that they would hold water without any coating. Some baskets were lined with clay and used in cooking. These vessels were not placed directly over a fire. The contents were heated by dropping hot stones in the baskets.

Basketry was also used in making various articles of clothing. Sandals made of it were used by some tribes instead of moccasins of hide. Head baskets, serving for protection from the sun and rain as well as for adornment, were the forerunners of modern straw hats.

Captain John Smith spoke of shields and armor used by the Indians in warfare. These were woven so

WEAVING BASKETS BY MACHINERY

For thousands of years mankind has been making baskets by hand by sticking upright spokes into a frame and weaving cross-strips through them. Today many baskets are made by machines, the wicker being fed into the shuttles from spools.

firmly that no arrow could pierce them. Basket boats were used by the Indians, as they were by the early Britons, and as they are to this day on the Tigris and Euphrates rivers (*see* Boats).

The woman of the household made the baskets. She was the burden bearer, and she learned to weave vessels that were light yet strong and durable for carrying clay from the quarry; water from the spring; stones for grinding meal; firewood, fruits, seeds, roots, fish, flesh, and fowl for the household.

The primitive Indian squaw had a keen sense of beauty, and this she expressed in her baskets. She learned to extract dyes from roots and berries to color them. She made ornaments of shells and stones to decorate them. She used the feathers of birds—the red of the woodpecker's crest, the

orange of the oriole, the green of the mallard duck—to beautify the gift baskets known as "jewels."

Most beautiful of all were the designs woven into the baskets. Many of these designs represent objects in nature—the rainbow, the flowing water, the zigzag lightning, mountains, trees, flowers, birds, and animals. Here too are strange symbols, telling of witchcraft and magic, legends of gods and heavenly beings. Into her baskets the weaver put her feelings, her dreams, and her prayers, the traditions and ideals of her tribe.

How You Can Make a Simple Basket

Boys and girls through patience and practice can learn to make beautiful baskets with simple materials and a very few tools. Those who live in the country can utilize some of the native materials used by the Indians—peeled twigs of the willow, or osier, split cattail leaves, flags and rushes, and the tougher grasses. Those who live in the city or who do not wish to prepare the native plants may use materials already prepared, such as rattan and raffia.

Rattan is a climbing plant which grows in the forests of the East Indies, twining about trees and hanging from the branches sometimes for a length of several hundred feet. It is stripped of leaves and bark and split into round or flat strips of various sizes, often called reeds. Raffia is a fiber obtained from the gigantic leaves of a palm that grows on the island of Madagascar. It comes in long strips that are very tough and pliable. In basketmaking it is sometimes used alone, but more often in connection with rattan.

Here are directions for making a simple rattan basket. A heavier rattan should be used for the spokes or ribs of the basket than for the weaving cane. The only tools needed are a pair of strong, sharp shears, a ruler for measuring, and a deep water pail.

Cut from the heavy rattan four 14-inch spokes and one 8-inch spoke. Have ready one of the finer reed

(to be used as the weaving cane) which you have previously soaked for an hour in cold water or 15 minutes in hot. Arrange and cross the spokes as shown in Fig. 1, inserting the 8-inch, or half spoke, between the halves of one pair of spokes.

Hold the spokes in position with the left hand. Take the weaving cane in the right hand and bind it firmly about them as shown in the diagram, going twice around. Then separate the spokes so that they radiate at equal distances

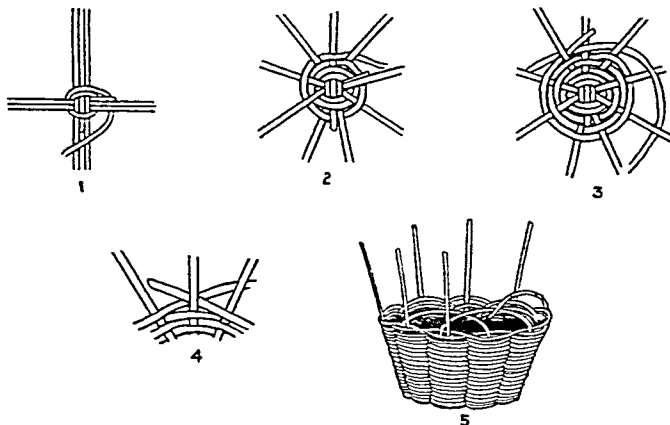
in all directions, as shown in Fig. 2. Now begin the weaving—that is, pass the weaving cane over one spoke and under the next, going from left to right. The spokes should be very evenly separated and the weaving cane pressed down firmly with the forefinger as it is brought around. The strength and beauty of your basket will depend upon the care with which you do this.

When you have a mat or base several inches in diameter, wet the spokes and bend them sharply upward to make the sides of the basket. If the basket is to have straight sides, the spokes should be bent at right angles; if sloping sides, at an oblique angle. In weaving the sides care should be taken to press each row close to the one before it.

Two or more weaving canes will be needed to complete this basket. When the first weaving cane runs out, leave about half an inch behind a spoke and cross this with an equal length of the new weaving cane, as in Fig. 3. The end of the last weaving cane is placed as in Fig. 4.

To finish the edge of the basket, cut the spokes to an even length of about three inches beyond the weaving and trim each to a point. Hold the ends in water for a few minutes to make them pliable. Turn back each spoke in the opposite way from which you have been weaving and insert the point beyond the next spoke, as in Fig. 5. Bend the spoke downward at least an inch below the edge of the weaving so that it will remain firmly in place and press the top level with the last line of weaving.

THE FIVE STEPS IN MAKING A BASKET



Whether boys and girls live in the country or in town—for there is plenty of material to be had in both places—they can get a great deal of pleasure as well as gain skill in handicraft from making baskets. These diagrams show the five steps in the process, as explained in the text.

A POPULAR SPORT *Around the WORLD*



Leaping high into the air a University of Illinois player (white uniform) attempts to tip in a rebound shot. The goal is defended by Ohio State University players (dark uniforms). Controlling the rebounds is important to winning.

BASKETBALL Fast action and lively team play make basketball one of the most exciting of games. The players on both teams are constantly in motion making quick starts, sharp changes of direction and sudden stops. Meanwhile they may pass the ball from one to another at the rate of about one pass every second. Throwing and catching the ball while moving at top speed require the closest kind of teamwork. The defensive players must also work together as a team if they are to prevent their opponents from scoring.

In basketball a score can be made at any instant. A player scores when he throws the ball into the basket. Both teams score frequently and the total points for both sides is often more than 100.

The Players, the Court, and the Ball

There are five players on a team—a center two forwards and two guards. All players should be in good physical condition. Tests have shown that the average player travels about four miles during every

game and moves most of this distance at top speed.

Basketball is played on a court either indoors or outdoors. The ideal dimensions of the playing floor are 50 by 94 feet for colleges, 50 by 84 feet for high schools and 42 by 74 feet for junior high schools. At each end of the court is a goal or basket 10 feet above the floor. It consists of a black metal ring 18 inches in diameter with a net of white cord suspended from the rim. Each basket is attached to a backboard measuring 6 by 4 feet. The inflated leather-cased ball is from 29 to 30 inches in circumference and weighs from 20 to 22 ounces.

How the Game Is Played

The visiting team has the choice of baskets at the start of the game. The teams change goals for the second half. At the beginning of play the referee tosses up the ball between the opposing centers who stand inside the center circle at midcourt. The other players must stay outside the six-foot outer circle until the ball is tapped. The team that receives the ball from this center jump then tries to advance the ball toward its own basket. When the ball is within scoring range any player may throw (shoot) the ball into his basket. A successful throw is called a *field goal*.

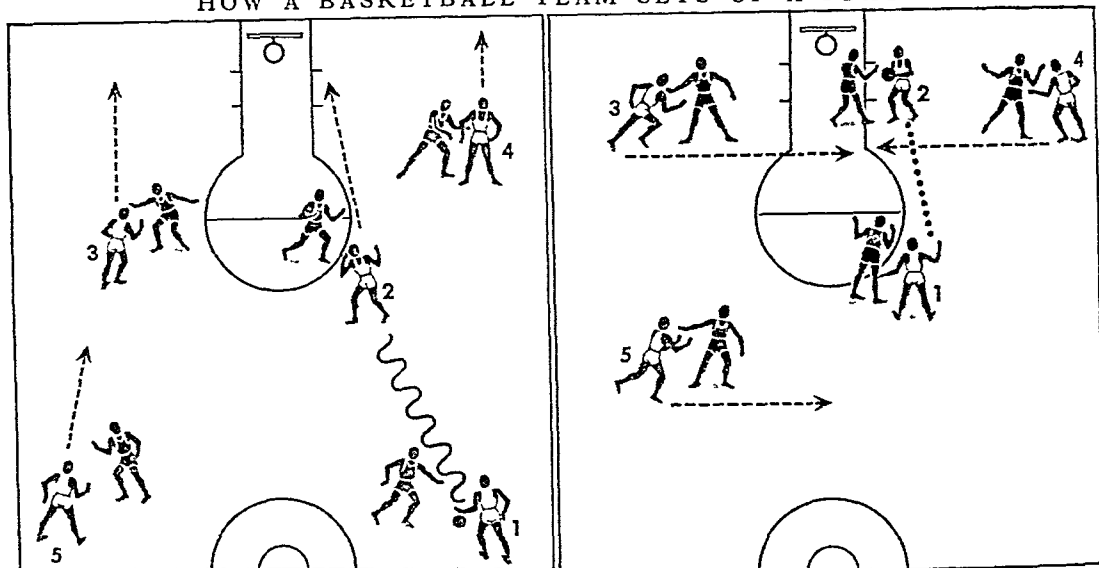
A player with the ball may not carry it more than one step in any direction. He must pass it to a teammate or *dribble* it—that is, bounce

the ball back and forth between either hand and the floor so that it keeps pace with him as he dashes toward his goal. The ball may be batted with the hands passed, bounced or rolled in any direction. Carrying, kicking or punching it are violations which the referee penalizes by awarding the ball to an opponent out of bounds. The quickest and best way of advancing the ball to within scoring range of the basket is by rapid fire passes between teammates.

To hold trap charge or push an opponent is a foul. A player who is fouled receives one *free throw*. If he makes it he receives a bonus of one additional free throw. If a player is fouled while in the act of shooting and misses the basket he receives two free throws; if he makes the basket the score counts and he receives one free throw.

A basket made from the field counts two points, one made from a free throw counts one. If an attempt at a free throw or field goal misses the ball con-

HOW A BASKETBALL TEAM SETS UP A PLAY



1 Player No. 1 on the White team dribbles down the court while his teammates take their positions. As he reaches the free-throw circle, he can shoot for the basket or pass to any of his teammates. The Black team is using a man-to-man defense. Each Black player tries to stay between his man and the basket.

2 No. 1 has passed to No. 2, the pivot man of this play. No. 2 can pivot and shoot or pass to a teammate. The forwards No. 3 and No. 4 cross in front of the pivot man. Either can block ("screen") the opponent who guards the teammate. No. 2 then passes to whichever man is free to shoot or to dribble in for a closer shot.

tinues in play. After each basket the team that was scored on puts the ball in play from out of bounds. An exception to this rule occurs after a *double foul*, or body-contact foul, called against two rival players at the same time. In this case the ball becomes "dead" (out of play) while the free throws are attempted. Play is then resumed with a center jump.

To prevent "stalling," which slows up the game, the team that has the ball in its own back court must bring it over the center line within ten seconds. If the ball goes outside the court, the referee decides which player touched it last and gives the ball out of bounds to a member of the opposing team. During play two opposing players may get a firm grip on the ball. The referee then declares a *held* or *tie* ball. He tosses up the ball between the two contestants just as in the center jump.

Three Types of Defenses

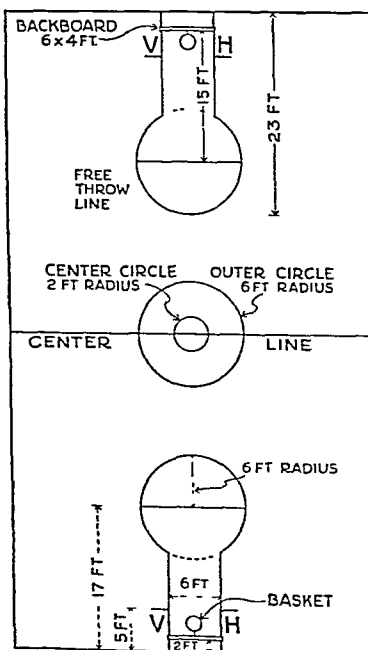
Most teams use one of three defenses—zone, man-to-man, or a combination of both. In a zone defense, each defensive player guards a certain area of the court. The zone may be *shifting*, with all the players concentrating on the same side of the floor as

the ball; or *static*, with each player remaining in his general defensive area. In a man-to-man defense, each player guards one specific player of the opposing team. In a combination defense, two or three players guard certain zones. The others play a man-to-man defense.

Why Players Should Avoid Roughness

There are two kinds of penalties—violations and fouls—for breaking the rules in basketball. The chief officials—referee and umpire—punish violations by awarding the ball to the opposing team out of bounds. Common violations are: breaking the ten-second rule, taking more than one step with the ball without dribbling (traveling), double dribble (using both hands to dribble), and having an offensive player remain in the free-throw lane or circle more than three seconds.

Personal fouls result from physical contact with an opposing player such as holding, tripping, or charging. These rules prevent rough play to avoid serious injuries. The officials call the fouls and penalize offenders by awarding free throws to their opponents. Two free throws are awarded for a deliberate foul and for any personal foul called during the last



The maximum size of a regulation court is 50 by 94 feet; minimum, 42 by 74 feet. V shows position of visiting player during free throws; H, position of home-team player.

three minutes of a game. A player guilty of committing five personal fouls must leave the game.

Technical fouls are called against players for delaying the game or for using unsportsmanlike tactics such as talking discourteously to officials. Any member of the opposing team may shoot the penalty throw. After the free throw attempt, the shooting team takes possession of the ball out of bounds at midcourt.

Length and Number of Periods

The length of the game is regulated according to the age and physical ability of the players. College teams play two halves of twenty minutes each with a 15-minute rest between halves. If the score is tied at the end of the second half, play continues for as many five-minute overtime periods as are needed to break the tie.

High-school teams play four quarters of eight minutes each with a ten-minute rest at half time. If the score is tied at the end of the fourth quarter, an overtime period of three minutes is played. If necessary, the game continues until one team gains a two-point lead or until one team leads by one point at the end of the second or a later overtime period. Boys 14 years old and younger play four six-minute quarters with a rest of ten minutes at half time.

Playing in Basketball Tournaments

In many states the climax of the high-school basketball season is the annual state tournament. In this competition, winning high-school teams advance through a series of elimination tournaments until a

state champion is crowned. The final games are usually held in the gymnasium of some university.

For large college teams, the feature of the season is the tournament staged by the National Collegiate Athletic Association (N.C.A.A.). Conference champions and leading independent teams compete for the national college championship. (For a list of teams in the largest college conferences, see Football.) Thirty-two of the best small college teams take part in the National Association of Intercollegiate Athletics tournament held annually at Kansas City, Mo. Other college teams may participate in special tournaments such as the National Invitational Tournament staged annually in New York City by the Metropolitan Basketball Association. The Y.M.C.A. and the Amateur Athletic Union hold their own tournaments for noncollege amateur teams.

Combining Business and Pleasure

Professional basketball teams employ many excellent stars. Most professional teams play four 12-minute quarters and scores of more than 100 points a game are common. The maximum number of fouls permitted is usually six. Professional teams preferred the practice of keeping individual playing records of the number of rebounds taken and the number of scoring assists in each game.

The largest professional league is the National Basketball Association, formed in 1949. It is divided into two divisions—an eastern group of five teams and a western group of four teams. In the eastern

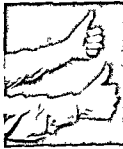
SOME OF THE SIGNALS USED BY A REFEREE



Illegal dribble



Illegal use of hands



Held, or jump, ball



Time in



Time out—a foul



Score counts 1 free throw



Technical foul



Out of bounds there

In a basketball game, the referee starts or interrupts play by blowing his whistle. He then uses a series of hand signals

to indicate his decisions to the players, scorers, and spectators. Pictured here are eight of the common signals used.

division are the Baltimore Bullets, Boston Celtics, New York Knickerbockers, Philadelphia Warriors, and Syracuse Nationals. Western division teams are the Fort Wayne Pistons, Milwaukee Hawks, Minneapolis Lakers, and Rochester Royals.

At the end of each season the two divisions hold a play-off with the winners meeting in a world series of basketball for the professional championship. The greatest professional star, George Mikan, was a 6-foot, 10-inch center from DePaul University. In a poll of sports writers and broadcasters, Mikan was voted the outstanding basketball player in the history of the game.

How Girls Play the Game

Many girls' teams play according to boys' rules. Others play the official basketball rules for women. This game calls for teams of six members—three forwards and three guards. Only the forwards are allowed to throw for the basket. Players do not range the entire court as in boys' basketball. The playing floor is divided into two zones at mid-court, and the forwards must stay in the forwards' zone and the guards in the guards' zone. The game consists of four quarters of not more than eight minutes each, with a ten-minute rest between the second and third quarters.

Most of the interest in girls' basketball is centered on the Amateur Athletic Union tournament held annually at Wichita, Kan., or St. Joseph, Mo. Most of the championship teams that have emerged from this tournament have come from the southwestern or southern parts of the United States.

The History of Basketball

Basketball was invented to meet a demand for a game that could be played indoors in winter between the football and baseball seasons. It is the only major sport that is completely American in origin. Sports such as football, baseball, and boxing had early forerunners in other countries.

The game was invented late in 1891 by Dr. James A. Naismith, a physical education director at the Y.M.C.A. training school in Springfield, Mass. Dr. Naismith hung two peach baskets at opposite ends of a gymnasium for goals and used a soccer ball for play. He then devised 13 rules for the conduct of the game. The first official game was played Jan. 20, 1892, with nine men on a side.

With surprising speed, the game of basketball spread to schools, colleges, and athletic clubs all over the United States. The game also proved extremely popular abroad. It was permanently added to Olympic Game competition in 1936.

Basketball draws as many as 75 million paid admissions a year, more than any other sport. The large attendance figures result from the great number of teams playing the game. In every state, boys and girls play basketball in grammar school, high school, college, and athletic clubs. Many teams represent towns, churches, and business houses. In addition to amateur teams, there are many independent professional clubs throughout the nation. The most famous of these is the Harlem Globe Trotters.

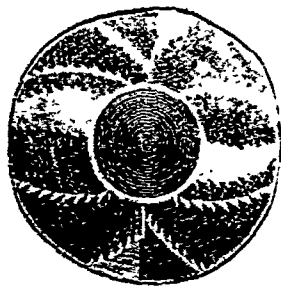
BASKET MAKERS. Two thousand years ago, a roving people settled in shallow caves in the arid plateau that spreads out from the point where Colorado, Utah, Arizona, and New Mexico now meet. Archeologists who excavated their homes called these folk Basket Makers because many fine baskets were found in the burial pits. They named the civilization begun by them the "Anasazi culture" from a Navajo word for old peoples.

These people gathered wild seeds and fruits, hunted small game, and cultivated corn, beans, and other plants. They stored food for winter use in pits dug in the caves or in rude dwellings which they erected later. The pits were lined with slabs of stone and plastered with mud. The dead

were buried in a pit, along with their belongings, and the pit was sealed. The dry air has preserved the bodies and equipment in many of them for study today.

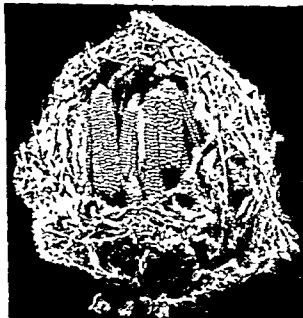
Early Basket Maker hunters hurled darts with a throwing stick, called an *atlal*, and used clubs and nets. Later, they learned to make bows and arrows. The men wore little clothing in summer, but protected their feet with grass sandals and wore fur-cloth robes in winter. The women wore short apron-like cord skirts, and sandals. They wove fur cloth and feather cloth. Their baskets and bags were decorated with attractive designs. Some of the conical willow burden

AN ANCIENT ART



A specimen of the Basket Makers' craft is the conical basket pictured here. It is now in the American Museum of Natural History. It has the sun-and-mountain design.

STORED 3,000 YEARS



This cache, used to preserve corn and other stores, was found in a cave in Cave Lake Canyon, Utah. It is now in the Museum of the American Indian, in New York City.

baskets were three or four feet wide.

About the time the Basket Makers began to gather into villages, the women experimented with the first pottery made on this continent. They built up clay in basket bottoms and dried it in the sun. Later they learned to fire the pots, and in time added decorations.

Skeletons and mummies of Basket Makers show that

they were much like their descendants, the modern Pueblo Indians. They were rather short, with brown skin, coarse black hair, and long (dolichocephalic) heads. Later prehistoric Indians, sometimes called Cliff Dwellers, continued the development of Anasazi culture (see Cliff Dwellers; Pueblo Indians).

BASS For fight and flavor, anglers prize the bass tribe. The fish that go by this name range from the six inch rock bass of the Mississippi River basin to the sea bass or jewfish that may grow eight feet long and weigh 700 pounds.

The small mouthed black bass of the Great Lakes region is often called the gamest of all fish. It may grow to weigh six pounds. Its rival, the large-mouthed black bass, ranges south to Florida where it grows to weigh over 15 pounds. The males and females of both black bass species fight fiercely to protect their eggs and young.

Important food fishes are the yellow bass (one-half to five pounds) of the Mississippi Valley, the white bass (about three pounds) of the Great Lakes region and the striped bass (up to 25 pounds) of the mid Atlantic and California coasts. The black sea bass, caught on the Atlantic coast weighs one to five pounds.

The small mouthed and large-mouthed bass and the rock bass belong to the sunfish family *Centrarchidae*. Other family names: Jewfish *Epinephelidae*, white yellow and striped basses *Moroneidae*, black sea bass *Serranidae*.

BAT Perhaps you have mistaken them for birds as they zigzag through the air at sunset. But bats are mammals—the only mammals that fly. They have soft fur, large ears, strong and sharp teeth and the young are born alive and get milk from their mothers.

The most astonishing thing about them however is their remarkable equip-

SCOOPING IN AN EVENING MEAL

Here a bat flies at full speed with mouth open to scoop up insects. The picture shows the bony framework of the wings.



ment that guides them in flight. Through the ages, men with inquiring minds wondered what enabled them to chase insects on the darkest night through the thickest forests without striking a single branch or twig. Finally experimenters sealed up the eyes of a number of bats with gum and released them in a large room where many ropes hung close together from the ceiling. They flitted about with their customary bullet speed without once colliding with any obstacle, proving that they did not depend on eyesight for guidance. When their ears and mouths were sealed however, they blundered about helplessly. It was found that a bat as it flies gives a continuous cry, so high pitched that most people cannot hear it. These supersonic, or high frequency, waves strike the obstacles in the bat's path, and echo back to its sensitive ears. Automatically the wings react to the signals, and the bat avoids the obstacle.

About 300 kinds of bats are known, and they live in all but the very coldest climates. In the United States the little brown bat is the most abundant. It is found throughout North America, and is common about towns and villages.

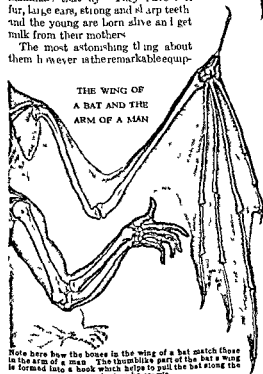
Habits of the Brown Bat

The brown bat is only $3\frac{1}{2}$ inches long and weighs about half an ounce. Like all its insect-eating relatives, it hunts its food in the air. Sometimes it alights on the ground to catch beetles, crickets, and other insects. It crawls with great difficulty, using its wings as feet. It cannot spring into the air from the ground. To start flying it must crawl up on something and drop off. During the daylight hours it retreats into caves and hollow trees under caves and roofs, and in attics and old buildings.

Between May and July the female bats gather in colonies of a hundred or more in dark hiding places. They drive away all the males, and each one gives birth to a single naked, pink, and blind baby. There is no nest. While the mother goes hunting she hangs the baby up by its feet. She returns often to nurse it. The young reach full size and can fly when they are three weeks old. Bats may live ten years or longer. Owls are among their few enemies. During the winter the little brown bats hibernate in caves.

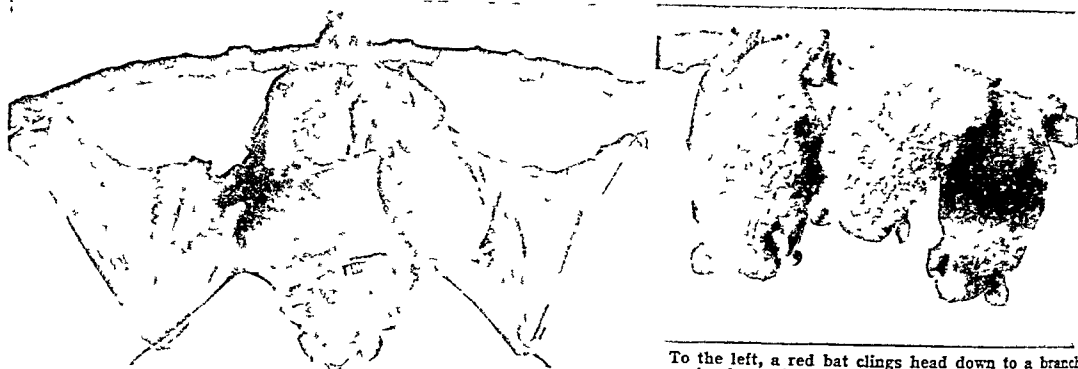
The red bat is common from Canada southward. It is a beautiful little animal, about $4\frac{1}{2}$ inches long, with soft fluffy red fur. It is a forest dweller,

THE WING OF
A BAT AND THE
ARM OF A MAN



Note here how the bones in the wing of a bat match those in the arm of a man. The thumblike part of the bat's wing is formed into a hook which helps to pull the bat along the ground when he crawls.

FIRST THEIR SUPPER AND THEN TO BED



To the left, a red bat clings head down to a branch while she suckles her three young. When she flies off to hunt, she hangs them up as shown above, for they have grown too big to ride with her.

spending the daylight hours hidden among the leaves. It bears from one to four young. The first few days after their birth the babies cling to the mother's breast as she flies about in search of food. Red bats migrate in winter to the southern limits of their range.

Harmful and Helpful Bats

No large bats live in the United States or other temperate-climate countries. In the tropics, however, some bats attain relatively huge size. The flying foxes of the Malay region may have a wing spread measuring five feet. These and other large bats found in the tropics are fruit-eaters and do a tremendous amount of harm to crops. But the insect-eating bats are extremely useful to man. In certain parts of the South they are so valued for the good they do in destroying harmful insects and also for the guano they produce for fertilizer, that huge roosts or shelters have been erected for them.

Many false tales are told about bats, such as the one that they carry common lice or bedbugs. The parasites on bats are peculiar to the bats themselves and will not attack man. Another tale is that they entangle themselves in women's hair. If such a thing ever happened, it was accidental. There are, however, certain tropical *vampire* bats which draw blood from animals or sleeping humans. These little creatures puncture the flesh, lapping up the blood as it oozes out. For some unexplained reason this blood taking is painless, and the victim is unaware of it. It is said that these bats

have never been known to attack a waking man, no matter how still he lies. Vampire bats are common in parts of Central and South America, but are never found in the United States. Certain of them spread disease among cattle and horses. These bats get their name from the "vampires" of old-time legends—ghosts which were said to come out of their graves at night to attack the living.

How to Catch a Bat

In your own immediate neighborhood there may be great numbers of bats. Perhaps a young one may

have been caught away from its roost when the sun came up. It will be hanging on a twig or against a wall with its wings folded about its head and body. Its attitude seems to be: "I don't see anything; nothing sees me." You may capture it if you wish. Better wear a glove, for although it can do you no real harm, its tiny teeth are sharp. Be very careful how you hold it, for you must remember that its wings are extremely sensitive. Your touch is like a rasping file and the bat will shiver and tremble in your hands. Take it indoors and place it on a table. It will crawl to the edge, then take off and fly about the room. If you place it on the floor, it will try to climb up with its sharp claws to a jumping-off place. A bat is unhappy in a cage, and soon dies.

If a bat flies into a room through an open window, it may be easily caught and removed. Shut the door so it cannot get into the rest of the house and

FLYING FOX OF THE EAST INDIES



This ferocious-looking giant fruit bat awoke while his picture was being taken. When eating, he hangs by one foot and seizes the fruit in the other, using his front claws as forks.

wait until it is fluttering in a corner of the ceiling as it will do in its efforts to find an escape. Then toss up a large piece of soft cloth. The bat will become entangled in it and will fall with it to the floor.

Bats belong to the order *Chiroptera*, so-called from the Greek words meaning "hand winged." The species most often seen in the northern United States are the little brown bat (*Myotis lucifugus*) and the red bat (*Myotis borealis*). Scientific name of common vampire, *Desmodus rufus*.

BATON ROUGE, LA. The very name "Baton Rouge" reflects the city's start. The words are French for "red stick" or "red pole." They refer to a reddish cypress pole which the Indians were using as a local boundary when the first French arrived. Later the location became the state capital of Louisiana, and in the 20th century, discovery of petroleum nearby and development of water shipping built the modern city.

Baton Rouge crowns a bluff on the east bank of the Mississippi River about 70 miles upstream from New Orleans. Ocean vessels can come here from the Gulf of Mexico through a dredged channel 35 feet deep. Large industrial plants along the river produce gasoline and oils, chemicals, synthetic rubber, cane sugar, asphalt, and aluminum products.

Behind the water front are both modern and pioneer features. The Louisiana State Capitol, completed in 1932, rises 34 stories and is the tallest structure of its kind. Memorials of the past include the old state capitol completed in 1852 and the meliorated, gray-brick pentagon buildings built by the United States Army between 1819 and 1829. Louisiana State University has a campus of about 4,700 acres and many striking buildings. Other features of the city include schools for the handicapped and old mansions.

Early Days in Baton Rouge

In 1719 the French built a fort on the site. Thereafter the region was held by Britain, Spain, France once more, and finally the United States. Baton Rouge was made the capital of Louisiana in 1819, but events in the Civil War and Reconstruction periods placed the capital in other cities between 1862 and 1892. Baton Rouge has been the scene of three battles. The Spanish

PORTRAIT OF A VAMPIRE



Here a notorious bloodsucking bat shows its demonic like profile. But it is not much larger than a mouse. Moreover, its bite is painless.

took it from the British Sept. 21, 1779. On Sept. 23, 1810, the citizens revolted against Spanish rule, and on Aug. 5, 1862, Confederate troops attacked Union forces then holding the city.

The city government was combined with that of East Baton Rouge Parish in 1919. It has nine councilmen and a mayor president (See also Louisiana). Population (1950 census) 125,629.

BATTERY Ranking high among our modern "unseen servants" are electric batteries. Automobiles and trucks have them to start their engines and supply current for the ignition and the lights. Flashlights need small batteries. Huge ones drive submarines under water and supply current for telephone systems.

Invention of the electric battery started the Age of Electricity. Formerly men could only study the effects produced by static or frictional electricity.

After experiments by Galvani and Volta led to the first battery, scientists had a steady current for studying electricity and for developing means of using it. One result is that today atomic energy is turned directly into electricity by atomic batteries.

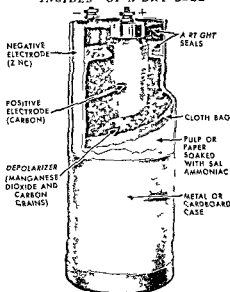
Electrochemical Basis of Battery Action

Batteries work by harnessing certain electrical properties of matter. As explained in the articles *Atoms and Electricity*, the atoms of every kind of matter are made up largely of tiny electrified particles called protons and electrons. Protons have a positive (+) electric charge, and electrons have a negative (-) charge.

These two kinds of charges attract each other. Normal atoms have equal numbers of particles with each kind of charge and mutual attraction

between the charges tends to hold the atom together. If something happens to break electrons away from certain atoms, the electrons tend to rejoin the positively charged remainders of the atoms by any path that is open. (Particles in this electrically active state are called ions.) In particular, ions

INSIDES OF A DRY CELL



This standard 1½ volt dry cell is used for such purposes as ringing doorbells, where a small current is needed for short intervals of time. It is cut open to show the arrangement of the parts. How they work is told in the article.

flow readily through metals and solutions of acids and salts. The flow constitutes *electric current*.

The (+) and (−) signs came into use before electrons were discovered. In those days, electricity was supposed to flow from places where it was in excess (+) to locations where it was deficient (−). When protons and electrons were discovered, they had the kind of electric charges found in (+) and (−) locations; but the electrons flowed from (−) to (+). The signs are still used, although they have lost their original meaning.

How Current Is Generated

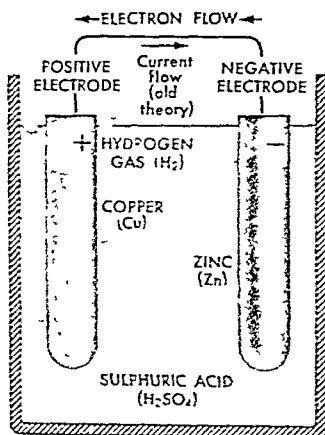
The simplest arrangement that can provide continuous current uses two pieces of unlike metals called *electrodes*, a conducting solution called an *electrolyte*, and a wire or other connector between the electrodes outside the electrolyte. Different metals are used for electrodes, for reasons explained in the article on Electrochemistry. (A single unit of this kind is called a *cell*. A *battery* consists of several cells acting together.)

The simple cell shown in adjoining diagrams is often called *voltaic* because Volta developed it. The electrodes are of copper and zinc, and the electrolyte is sulphuric acid (H_2SO_4). In solution, the acid divides into ions. Each SO_4 ion takes the two electrons which normally belong to the hydrogen atoms and thereby gains two (−) charges. The hydrogen atoms become ions also, because loss of their electrons leaves them with unbalanced (+) charges. The charges can reunite only by passing through the electrodes and the outside connection, or *external circuit*.

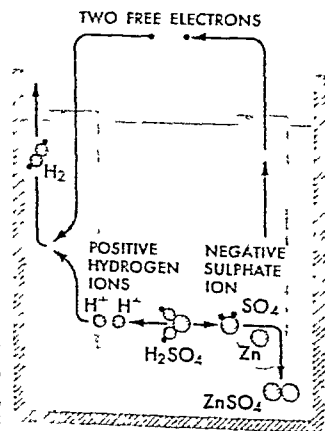
This cannot happen if the external circuit is *open*—that is, incomplete. But the moment the circuit is *closed* (completed), the negatively charged electrons can respond to attraction exerted through the copper electrode by the (+) hydrogen ions. They start flowing through the wire as electric current. Meanwhile the SO_4 ions draw zinc atoms from the electrode, and form zinc sulphate. This action releases more electrons and keeps up the flow of current.

At the copper electrode the electrons unite with hydrogen ions to form normal atoms. The atoms form molecules (H_2), and these bubble

THE SIMPLE VOLTAIC CELL



Here are the parts that are needed to produce electric current. How they work is explained in the article.



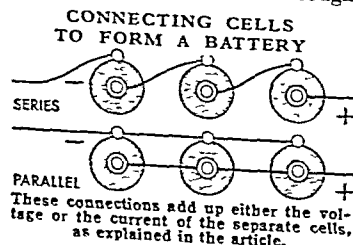
This diagram shows how one molecule of sulphuric acid acts to produce current. Two electrons, from each of two hydrogen atoms, show the various steps involved.

carbon grains served as a *depolarizer* to absorb hydrogen as it was formed. The mixture must be moist, so a "dry" cell is dry only because it is tightly sealed.

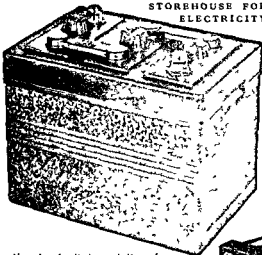
Joining Cells to Form Batteries

Cells are joined in batteries to give increased voltage, current (amperage), or both. Voltage is a measure of the electromotive force (E.M.F.) which moves current through the circuit, and it arises from the electrical characteristics of the material used. Size does not affect it. Size does, however, determine the amount of current.

To increase voltage, cells are connected in *series*, with (+) terminals connected to (−). The same current passes through all, and each cell adds E.M.F. in turn. Increased current is obtained by



STOREHOUSE FOR ELECTRICITY



Above is a 6 volt storage battery of the type used in automobiles. It consists of three 2 volt cells connected in series by lead straps. At the right the interior construction of one of the cells is shown. The small drawing illustrates how the negative and positive plates are intermeshed; the larger drawing shows plates and separators in place. This is an 11 plate cell (6 negative and 5 positive plates). Cells with more plates can stand heavier current drain, but their voltage is the same.

connecting like terminals in parallel. Thus each cell adds current to a common stream, but each cell expends its E M F adding to the current and voltage is not increased. A set of interlaced positive and negative plates, with each kind connected to a single terminal, will give the same result.

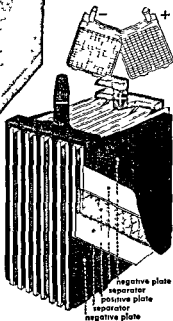
Both current and voltage can be increased by using many cells with series-parallel connections. Cells are series-connected into batteries to build up voltage, and the batteries are connected in parallel to build up current.

Storage Batteries

The energy of dry-cell batteries comes from the reaction of the chemicals brought together first at the time of manufacture. When this chemical reaction ceases, such *primary* cells, as they are called, are "dead" and useless. Another type is called *secondary* or *storage* cells. These obey the same general principles that govern all electric cells but they have a reversible chemical action. When they are exhausted they can be recharged. In many respects they are more important than *primary* cells, for they are the ones used where great power is required.

The photograph and drawings on this page show the construction of the ordinary 6-volt automobile unit. This serves to illustrate the principle of all storage batteries. It is made up of three identical 2-volt cells. Each cell consists of a container full of dilute sulphuric acid (the *electrolyte*) in which stand the positive and negative electrodes.

Each electrode consists of a set of connected plates that fit between the plates of the opposite electrode. The plates are gridlike frames made of a hard alloy of lead and antimony. When the cell is new, the spaces of openings in the positive plates are filled with lead dioxide (PbO_2), those in the negative plate contain spongy metallic lead. To prevent the plates of one electrode from touching those of the other, thin separators of wood, glass, or plastic fit between them as shown in the drawing below.



Electricity is generated in the cell by a twofold chemical change. Metallic lead from the negative plates reacts with the sulphuric acid solution to form lead sulphate. This reaction can be completed only when the lead leaves free electrons behind on these plates, giving them a negative charge. The lead dioxide in the positive plates then reacts with the solution to form lead sulphate, plus water. This second reaction takes electrons away from the plates, leaving them with a positive charge.

When the cell is not in use, the electric charges accumulate on the plates until their "back pressure" prevents further chemical action. But when the cell is connected into a circuit so the charges can flow

away the chemical change is continuous. Lead sulphate is deposited on both sets of plates and the acid solution becomes diluted with more and more water. Gradually the energy of the chemical reactions diminishes and the flow of current from the battery weakens.

But if an electric current from another source, and flowing in the opposite direction, is now applied to the cell the chemical reactions are reversed. Lead sulphate and water react to form once again pure lead, lead dioxide, and sulphuric acid. The lead is deposited back on the negative plates, the lead dioxide on the positive plates, and the acid remains in solution. The cell has been restored to its original "charged" condition. This is what happens when you take your automobile storage battery to a garage for recharging.

Since a storage battery cell in use deposits the sulphate compound on the plates, the weight (actually, the specific gravity) of the solution gradually decreases. That is why a hydrometer serves to reveal the condition of storage batteries of this type. A fully charged battery will show a

hydrometer reading of about 1.30° ; a discharged battery will show about 1.15° (*see* Hydrometer).

After all the lead sulphate has been transformed in the course of recharging a battery, the recharging current begins to break up the water (*hydrolysis*) into oxygen and hydrogen which bubble away. This (plus normal evaporation) explains why water must be added to storage battery cells from time to time. The sulphuric acid, on the other hand, undergoes its chemical changes without loss.

In the *Edison storage battery* the positive plates contain nickel hydrate; the negative plates, iron oxide. The electrolyte used in this battery is a solution of caustic potash. Each cell develops only about 1.1 volts, but it is lighter in weight and longer of life than the lead-type cell. The *nickel-cadmium* battery, which was used for many years in Europe, has a positive plate of nickel and a negative plate of cadmium. The electrolyte is an alkali. This battery is especially useful for supplying very heavy current loads for a short time.

BAVARIA, GERMANY. The traveler who approaches this part of southern Germany from the north is struck by many contrasts. Bavaria is a region of green-clad mountains and fertile valleys, and its dark-haired people differ in many ways from their light-haired Prussian neighbors on the north. In general, they are more easygoing and tolerant, and they are more ardently devoted to music and color. Their country is the true home of German art.

Careless of the rush of modern factory industry, the Bavarian countryside has kept something of the warm picturesqueness of the Middle Ages. The peasants in the more remote valleys still wear quaint costumes, rich with embroidery and silver buttons. The herd-girls, in their dark full skirts and scarlet bodices with white sleeves, may still be seen guarding their flocks on the distant hills just as their forebears did four and five centuries ago. Even in the towns and larger cities descendants of the famous guild craftsmen of former days still labor in their little shops. They turn out the skilled handwork in wood and metals for which this part of Germany has been famous since medieval times.

In Contrast to Rest of Germany

Cut off by wooded mountains to the northeast and northwest, and by the towering snow peaks of the Alps to the south, Bavaria has until the past century run a separate course in spirit and politics from the rest of Germany. When their northern neighbors followed Luther in the Protestant Reformation, the Bavarians remained Roman Catholic. When Napoleon overran Europe, Bavaria sided with the French. When Prussia and Austria fought in 1866, it helped Austria. Even after the formation of the German Empire in 1871, Bavaria kept its own army and postal system, its own laws and customs, and its own royal family, which continued to rule until the revolution of 1918.

From the days of the Roman Empire, whose boundaries followed the Danube and Main rivers squarely through the middle of Bavaria, the Bavarians have been intimately associated with Italian civilization. A rich commerce flowed northward over the Alpine passes to the ancient cities of Augsburg, Regensburg (Ratisbon), and Nuremberg.

Bavaria thus early became a center of wealth and learning. Out of the intimate associations in which Bavaria formed the link between the Latins to the south and west and the Teutons and Slavs to the north and east, grew the cordial adaptable spirit found in the Bavaria of today.

The pack mules, heavily laden with the rich silks, tapestries, and spices of the East, which wound their way through the high passes of the Bavarian Alps, were gradually replaced by iron rails and locomotives. But old Nuremberg remained the commercial and industrial center of south Germany. Munich, which became the capital as well as the literary and art center of Bavaria, came to have a thoroughly modern appearance with its broad streets and beautiful buildings (*see* Munich; Nuremberg).

In the southern mountains lies the village of Oberammergau. From 1634 till the second World War, with few lapses, the villagers presented their famed Passion Play every ten years. It portrayed the last days in the life of Christ, interspersed with music and tableaux. About 1,000 villagers took part in the all-day drama (*see* Oberammergau).

A Land of Varied Products

Northern Bavaria is noted for its grapes and tobacco. But most of the crops, notably grain, hops, and potatoes, are grown on the Danube's alluvial plain that belts central Bavaria from west to east. The Alpine foothills in the south specialize in stock raising and lumbering. Porcelain clay, marble, granite, salt, iron ore, and other minerals are wide-

ROCKS INSTEAD OF NAILS KEEP THIS ROOF ON



Rocks are needed on the roof of this home in the Bavarian Alps to keep it from being blown away in the high winds of the region.

SCENES FROM UPPER BAVARIA'S VACATION LAND



In the Alpine villages of southern (Upper) Bavaria, the people have preserved the ancient customs and costumes. 1 A father and son on vacation wear the traditional lederhosen. 2 These picturesque houses of Garmisch are typical of the resort villages. 3 Setting off to a festival, this peasant wears a cocky green felt hat and light blue jacket. His wife wears a colorful dirndl costume. 4 A peasant and his oxen come to town with a load of kindling.

spread. Bavaria manufactures toys, porcelain, beer, chemicals, textiles, and iron and steel products.

For centuries Bavaria was one of the great duchies of the Holy Roman Empire. It became a kingdom in 1805 when Napoleon, in gratitude for aid given him, had its elector crowned. The kingdom joined the new German Empire in 1871. After the first World War, Bavaria set up a republic (1919) but joined the Reich again in 1933. At the end of the war (1945) it was included in the United States zone of occupation. Thousands of German refugees were admitted from Czechoslovakia's Sudetenland and from areas in eastern Germany occupied by Poland. Area, 29,334 square miles; population (1950 census), 9,126,010.

BEAN. One of the most valuable vegetable foods is the bean. It is rich in carbohydrates, proteins, minerals, and vitamin B. This food value makes beans an inexpensive substitute for meat.

Since prehistoric times beans have been useful to mankind. The *broad* bean has been eaten in Europe since men first began to grow crops. Beans were cultivated in Mexico and Peru long before the white man came.

This plant also helps to enrich the soil. Its roots shelter nitrogen-fixing bacteria. The surplus nitrogen not used by the plant is stored in the roots and passes to the soil when the plant dies (*see* Nitrogen).

Beans are pod-bearing (leguminous) plants. The pods develop from the butterfly-shaped flowers and are from two to eight inches long. These pods and the seeds within furnish us with food.

They are eaten at various stages of their growth, depending on the variety. Sometimes both pod and seeds are eaten together when still young and green. Sometimes just the seed is eaten before it becomes ripe. Most beans grown commercially in the United States are used as *dry* beans. The pods are allowed to mature fully and the dry beans are then harvested by machine.

There are many kinds of dry beans, both white and red. The white "navy" (*pea*) bean is used for baked beans. Michigan and New York lead in its production. The *Great Northern* closely resembles the pea bean. It is raised in the western states. California is the leading producer of dry *lima* beans. This state also grows most of the *black-eyes*. This type of cowpea is named from the black oval around its germ, or eye.

Among the red beans, the *red kidney*, the *pinto*, and the *pink* are the favorites. The red kidney, grown extensively in New York, is used for canned chili con carne. The pinto, a pinkish color mottled with brown, came originally from Mexico but is now grown in Colorado and New Mexico. The pink bean, another favorite of Latin America, is raised in California.

Snap or *green* beans are picked when the seeds are still small and the pod is juicy, since both seed and pod are eaten. A yellow variety is the *wax* bean. Snap beans are sometimes called *string* beans. But the threadlike growth along the edge of the pod, which gave them their name, has now been almost eliminated. Most fresh snap beans come from Florida. New York, Oregon, and Maryland raise large crops for canning.

Delaware, New York, and New Jersey lead in producing *green lima* beans. The Asiatic *mung* bean is raised in Oklahoma. In the Orient it has many uses, but in the United States it is raised mainly for its tender sprouts. These are used in Chinese dishes.

Many bean plants have other uses. The *scarlet runner* is grown as an ornamental vine. *Cowpeas* are grown to enrich the soil or as a forage crop. The *soybean* has many practical uses (*see* Cowpea; Soybean).

Beans belong to the family *Leguminosae*. The pea bean, Great Northern, kidney, pinto, pink, and snap bean are varieties of *Phaseolus vulgaris*. Scientific names of other kinds are broad bean, *Vicia faba*; scarlet runner, *Phaseolus coccineus*; cowpea, *Vigna sinensis*; soy bean, *Glycine max*; lima bean, *Phaseolus limensis*; mung bean, *Phaseolus aureus*.

THE SPROUTING AND EARLY GROWTH OF A BEAN

You can make this experiment in your home. Replace one side of a small wooden box with a pane of glass. Fill the box with earth and plant a bean against the glass about an inch below the surface. Cover the glass side with a piece of cardboard that can be removed for checking day by day the progress of the plant's growth. Eight stages of the growth are illustrated and explained below.



appeared. 8. The plant stands erect and its leaves catch the sun light. Plants get their energy from leaves and roots. Until these are well formed the sprouting plant lives on the food stored in the body of the seed. The two halves of the bean seed (cotyledons) have served their purpose. Now that their work has been taken over by the foliage leaves, they will wither and drop off the stem.

GIANTS and MIDGETS of the BEAR FAMILY



These Alaska brown bears are the largest members of the bear family. Some of the males weigh over 1,500 pounds, and when reared up on their hind legs to the full, they get a 9 metre feet tall. Included among the giant brown bears are the Kodiak bear, the peninsular giant bear, and other varieties of similar size and habit.

BEAR The bear family includes the largest of all flesh-eating land animals. Lions rarely weigh as much as 500 pounds and the biggest tigers stop short of 600 pounds, but the polar bear and the grizzly may weigh as much as 900 or 1,000 pounds. The great Alaskan brown bear has been known to scale 1,500 or 1,600 pounds. At the other extreme, the two smallest members of the family—the Malayan bear or sun bear and the spectacled bear of the Andes Mountains—weigh less than 100 pounds.

In character and habits bears show as much variation as they do in size. Some like the grizzly the polar bear and their tiny cousin the sun bear are likely to be short-tempered and savage. But most of the others are peaceful, easy-going animals. The polar bear is one of the best swimmers among land animals; the common black bear and most of his smaller relatives are skillful tree climbers.

Bears are also remarkably adaptable to varied conditions of life. Members of the family are found in mountains and lowlands and in every climate from the tropics to the Arctic. Almost all bears can adjust themselves easily to life in captivity. Their adaptability is particularly marked in their feeding habits. Though they are classed as flesh-eaters, their teeth are suitable for either tearing flesh or grinding vegetable food, and their diet is likely to include grass, grain,

roots, nuts, fruit, grubs, insects, snails, crabs, frogs, snakes, eggs, fish—almost anything in fact that is eaten by any animal. Most bears are especially fond of ants and of honey.

Bears seem clumsy creatures. This is due to their peculiar gait. In the first place, bears are plantigrade, or flat-footed: the heel of the foot rests on the ground like a man's (see Foot). In the second place, they move both legs on one side of the body forward at the same time. This gives them a rolling motion. Yet they can be swift and nimbly in action, galloping fast enough to overtake any human runner, and they can stand on their hind legs and strike out like a cat with their powerful front paws.

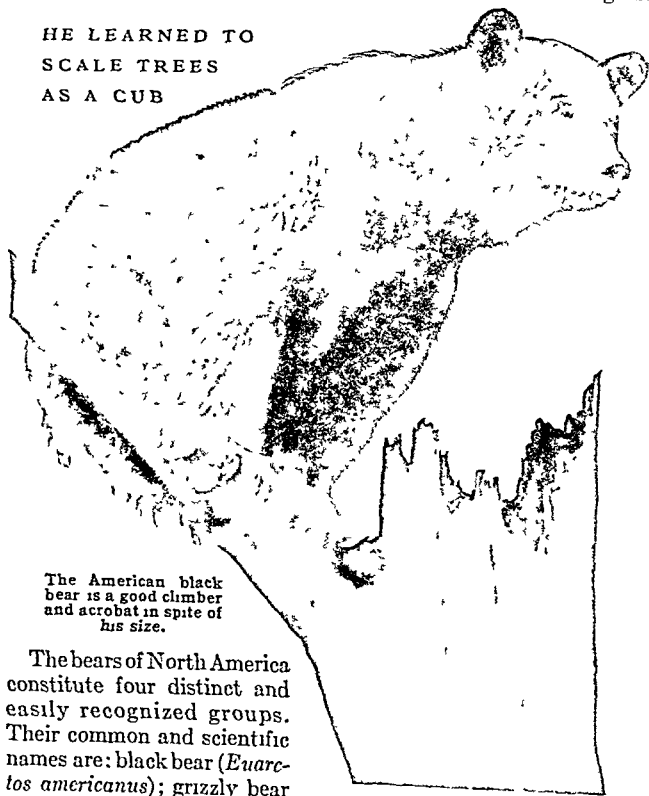
Their awkward appearance and their usually slow, deliberate movements have led to the common belief that bears are stupid. Old fables and folk tales often represent the bear as the victim of practical jokes played by the other animals. Zoo keepers, however, agree that bears are among the most shrewd and intelligent animals that they have to deal with. Many stories are told of their patient ingenuity in getting out of cages.

Most wild bears hibernate from two to six months even in warm climates where food is plentiful the year round, but in captivity they rarely do so. The winter quarters may be a cave, the base of a hollow tree,

or a den that the bear scoops out for itself. Sometimes it covers itself with leaves and grass, leaving only a small air hole (see Hibernation). Here, in the winter den, the young are born, from one to four at a time. The cubs are almost hairless and extremely small and helpless at birth. They remain with the mother for more than a year.

Bears are widely distributed throughout North America, Europe, and Asia, and some parts of northern Africa. Only one species is found in South America, and none in Australia.

HE LEARNED TO
SCALE TREES
AS A CUB



The American black bear is a good climber and acrobat in spite of his size.

The bears of North America constitute four distinct and easily recognized groups. Their common and scientific names are: black bear (*Euarctos americanus*); grizzly bear (*Ursus horribilis*); Alaska brown bear (*Ursus gyas*); polar bear (*Thalarctos maritimus*).

The black bear was originally found in all parts of the North American continent, except in the extreme north, and it still exists wherever there is extensive forest land sufficient to shelter it. Though persistently hunted for several hundred years, it is still found in the Adirondacks and in New England. In the fall when the coat of this bear is at its best, the fur is entirely black except for a brown patch on the muzzle and an occasional white spot on the breast. Its hearing and sense of smell are very keen and enable it to avoid its enemies. The least suspicious sound or odor is sufficient to start it from its lair, and it requires a skillful hunter to run it down or approach within rifle range. A large black bear may weigh 500 pounds or more, but the normal weight is much less.

The cinnamon bear is a color variation of the black bear, both types being found in the same litter. For a long time after its discovery the cinnamon bear was believed to be a distinct species, and most of the early accounts described it as being equal to the grizzly in size and exceeding it in ferocity. But science since then has established the true position of the cinnamon bear, and now it is regarded as the shy inoffensive animal that it really is.

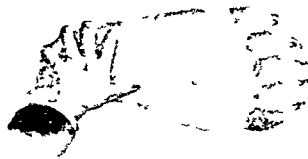
Five other sub-species of the black bear are now recognized, four of which closely resemble the main type. They are found respectively in Florida, Louisiana, Labrador, and Queen Charlotte Islands. The fifth, the glacier bear, is of a rare bluish-gray and is found in Alaska, in the vicinity of Mount St. Elias. Like the cinnamon bear, the glacier bear was formerly thought to be a distinct species, but a litter of young ones, in which both types were represented, established the true relationship.

The black bear is often seen in captivity and is a favorite with young and old. Its habit of standing erect, its droll appearance, and its plaintive appeals for dainties, which are generally accompanied by a whine like that of a child, give it a human aspect. This is further heightened by the amusing antics of the cubs, which may be likened only to the romping and wrestling of boys. Black bears have a keen sense of humor, as evidenced by their fondness for ducking one another in a pool. Dr. Hornaday says these bears are easily kept in captivity, and if properly fed and not too closely confined they are good natured and contented.

America's Fiercest Animal

The grizzly bear, or "silver-tip," inhabits the western part of North America from the Arctic Ocean to southern Mexico, and from the Rocky Mountains to the Pacific. There are several varieties. In size some about equal that of the black bear, but the largest reach a length of eight feet and a weight of about half a ton, and are capable of carrying off small horses and cattle. They vary in color from a light yellow to almost black. The tips of the hairs are lighter, giving them a grizzled appearance, whence come the names grizzly and silver-tip.

The grizzly is the fiercest and most dangerous American mammal. The Indians feared it and the warrior who overcame a large one was very properly regarded as a great brave. The grizzly possesses greater intelligence than the black bear, and when wounded or brought to bay is a dangerous antagonist. The coming of



The bear leaves a footprint much like a man's. The claw marks tell you that he cannot draw in his claws as a cat does.

ADVENTURES of BLACKIE and GINGER

The Story of two Little Bears



ON a day in summer two little bears were playing together on a hillside

'What can we do, Blackie?' Ginger asked her brother 'There must be lots of things we've never done yet'

'I'll tell you' Blackie answered 'Let's hide in the bushes so that mother can't find us when she comes back'

'You know very well that mother will find us!' Ginger said 'She'll smell us right away'

'I can hide so mother won't find me' Blackie boasted 'I can hide so she couldn't ever find me'

'You can not!' Ginger said quickly 'Mother can find anything anywhere just by smelling it'

Blackie did not answer. Going over to his sister he gave her a push that sent her sprawling on her little back. Ginger got to her feet and rushed at Blackie as hard as she could. She loved a rough and tumble just as much as he did.

Blackie saw her coming and was ready for her. Rising on his hind legs, he gave her a smack. This time Ginger did not fall, instead she rose to her hind legs too and cuffed Blackie on the ear.

The two little bears were so busy scuffling that they did not see the mother bear coming toward them. Suddenly her big paw reached out and

'Wooff!' said Blackie, sitting down on the ground very hard.

'Wuff!' said Ginger, landing near him.

'Stop it!' said the mother 'Listen to me! I have a treat for you. I know where there is something specially good to eat—something that you both like very much.'

'What is it? What is it?' cried both little bears.

'It is honey!'

'Oh—Oh—Oh!' Blackie and Ginger stood on their hind legs and waved their paws joyfully. 'Where is it, mother? Where is it? How did you find it?'

'I smelled it,' she answered. 'I think it is in an old tree on the other side of the hill. It won't take us long to get there. Come along! Single file!'

She started off rolling her great body from side to side. The little bears followed trying to walk just as she did. They lifted both feet on one side at the same time first the right and then the left, then the right and then the left. And they put their feet down flat just as she did, leaving tracks that showed the prints of their claws.

'Look, mother!' Ginger called out 'Blackie isn't coming! He's back there looking for grubs under a stone!'

Mother bear stopped and turned her head. 'Blackie!' she called sharply, 'come along! You can hunt for grubs any time, but you don't get honey every day.'

'But I'm hungry now' Blackie said, turning over a large stone with his front paw, 'and it's a long way to the honey tree.'

The mother bear started back toward Blackie. He gulped down a large fat grub and came running toward her. 'I'm coming, mother,' he called. 'I'm hurrying as fast as I can.'

The bees
buzzed
and
swarmed
angrily



Then for a while the two little bears followed her without a word.

Presently Ginger whimpered. "It's hot and I'm tired. We've walked a long way, haven't we?"

"I'm not tired," Blackie said. "I can walk ever and ever so far and not get tired."

"I wish the honey tree wasn't so far away," Ginger complained. "I wish we were back in our nice den, with mother to feed us."

"Ho! I don't," Blackie said scornfully. "We're too old to drink milk now. And anyhow, I like grubs and fruit and berries better—and honey," he added. "I like honey better than anything."

"I do too, only I don't like to walk so far to get it. Do you remember how dark the den was, Blackie?"

"Of course I do. I remember all about it. We were born there, and for a good many days we didn't open our eyes."

"I like honey better than anything," said
Blackie

"You don't remember that at all, Blackie Black Bear! Mother told you that—I heard her! And I heard her tell you that we didn't go out of the den until we were three months old! I don't believe you really remember anything about the den."

"I do too!" Blackie said crossly. "I remember that it was cold."

"That's because we didn't have nice thick fur then," Ginger said. "Mother told me that we didn't have much fur at all when we were born. We weren't very big either—we weren't much bigger than squirrels!"

"I was *never* as little as a squirrel!" Blackie said, very angry at the thought of this. "Was I, mother?" he called. "Was I ever as little as a squirrel?"

"Yes, you were," his mother said, "but you children had better hurry up. We are getting near the honey now. It's in that old hollow stump right over there."

The two little bears forgot everything else and ran to catch up.

"Um-m!" Blackie said, sniffing the air, "doesn't it smell good?"

"Yes," Ginger answered. "Only I hope the bees won't sting us the way they did last time."

The mother bear went straight to the stump. The bees buzzed and swarmed angrily, but she paid no attention. She began to scratch and tear at the rotting wood to make a hole big enough for her paw.

"Oh, dear!" cried Ginger, holding her paws to her tender little nose, "a bee stung me right on my nose!"

"Ouch!" Blackie cried at the same time, "a bee stung me on my head."

The mother bear kept on tearing at the stump with her strong claws. Her fur was so thick that the bees couldn't sting her easily. Even though one or two did sting her nose, she didn't mind much; she was so eager to get at the honey.

When the hole was big enough, she put in her paw and brought it out dripping with honey. "Delicious!" she said, as she licked off the sweet sticky stuff. Blackie and Ginger stretched up on their hind legs and





By and by each of them caught
a handful of little fish

put in their paws too. They gobbled down the honey as fast as they could. The angry bees stung them and the little bears whined and whimpered but kept right on eating.

"Wasn't it good?" Blackie said when all the honey was gone. "I wish we had honey every day."

"Well, I wish the bees wouldn't sting so hard," Ginger said, rubbing her sore nose.

"Come, children," their mother said. "We will go over to the shade, away from the bees, and take a nap."

The little bears were so full of honey that they were glad to lie down. Ginger dropped off to sleep at once. Suddenly Blackie raised his head.

"What's that, mother? What's that queer scratching sound I hear?"

"That is something you ought to know about. Come with me and I'll show you."

They waddled over to a clump of bushes near a tall smooth tree. The little bear looked through the bushes and saw a strange sight.

A huge bear was standing on his hind legs scratching on the tree as high as he could reach.

Blackie watched him a moment in silence. He couldn't understand what the bear was doing. He wanted to know. So he walked straight through the bushes and called out: "What are you scratching that tree for, Black Bear?"

The black bear stopped his scratching and looked down at little Blackie. "This is a scratching tree," he

said in a big gruff voice. "Don't you know what a scratching tree is?"

"No, I don't. What is it?"

"It is a tree that big bears scratch on."

"Why do you scratch on it?"

"So that other bears that come along will know who has been here. Look! That is my mark—the one that is highest up on the tree. No other bear who has scratched this tree is as big and strong as I am."

Blackie stared at him with big eyes. "He's a terribly big bear, isn't he, mother?" he said. "I'd like to be as big as he is."

"Maybe you will be some day," his mother said.

When they got back to where they had left Ginger she was awake and ready to play again.

"Now what can we do, mother?" she said. "I'd like to do something I've never done before."

"How would you like to fish?" her mother asked.

"Is it fun?" asked the little bears.

"Lots of fun, and besides fish are good to eat."

"As good as honey?" Ginger asked eagerly.

"They have a different taste," her mother answered, "but they're good."

Their mother took them down the hillside, along a path that other bears had made when they went to fish. Presently they came to a little stream. "Now watch me," she said, "and do just as I do."

She stood at the side of the stream and put her front paw in the water. For a long time she stood perfectly still, waiting. All of a sudden she scooped it

through the water with a splash and brought out a handful of little fish.

"Oh, let me taste them!" Blackie cried

"No! You will never learn to fish if I feed you. You must catch your own food."

So the two little bears stood beside the stream and tried to do just as their mother had done. At first they only brought up water in their paws, but by and by each of them caught a handful of little fish. They felt very proud of themselves.

Suddenly the mother bear rose to her hind feet and moved her head from side to side, sniffing the air.

"Climb this tree, children! Quick!" she said. "I smell danger!"

"I'm too tired to climb," Ginger said.

"Go up this tree, as I tell you!" the mother said sharply.

Ginger moved so slowly that her mother gave her a push. Blackie followed a little more quickly. The mother bear, back of him, prodded him on with her nose until at last they were all safely up.

For a while they lay very still on a high branch and waited. The mother bear kept sniffing the air. Presently she said: "I think it was that cross old lynx we saw last week. But he's gone now. Let's go down."

Then they all three climbed down again—tail first. Blackie and Ginger were even slower coming down than they had been going up, because they kept looking

down over their shoulders to see where they were going.

"I don't like to climb trees," Ginger said. "It's too hard for little bears."

"Coming down is worse," said Blackie. "I can't see where I'm going."

"You must always climb a tree when you smell danger," their mother said. "Remember that, both of you."

The sun had set and the air was getting chilly. Blackie and Ginger were sleepy.

"Can't we go back to the den tonight, mother?" Ginger asked.

"No," their mother said. "We will sleep out in the woods all summer. When it gets cold we will go to our old den or find a new one and stay there until it is spring."

"What will we eat?" Blackie asked quickly.

"We will not eat," his mother told him. "We won't be hungry. Before we go into the den we will eat and eat and eat until we are very, very fat! Then we won't need food all winter."

"I like fish," Ginger said sleepily.

"I like honey better," said Blackie.

"Enough talking, children! Go to sleep!"

The two little bears were so tired with all they had done that day, that they were glad enough to cuddle close to their mother and close their eyes.

"Climb this tree! Quick!
I smell danger!"



BEAR CLOWNS DELIGHT CIRCUS FANS



Wild bear may be fierce but tame ones love to play and perform. 1 This boxing bear has just knocked out his human opponent. 2 Even poor bears like to bellyflop down a slide. 3 This bear is too angry but he keeps pedaling his bicycle. 4 His friend falls from a bicycle and looks disgusted. 5 Bears too like to blow a loud blast on a horn.

many miles the river forms the boundary between Louisiana and Texas—lies about 22 miles east of Beaumont which is on the Neches River. Port Arthur on the west shore of the tidal 18-mile-long and 9 mile-wide Sabine Lake is about 17 miles south east of Beaumont. The Gulf Intracoastal Waterway enters the Sabine River from the east at Orange. From Sabine Lake it extends westward as far as Brownsville at the extreme southwest tip of Texas. Barge traffic over this waterway can reach every point of the Gulf Coast area and the Mississippi River system. Ocean traffic reaches the three cities through the canalized Sabine Pass, Sabine Lake, Sabine River and Neches River (see Canals).

All three cities have shipbuilding yards that make and repair barges and ocean going ships. The great industrial area also makes oil well drilling tools and machinery and large seagoing oil drilling dredges that pierce the offshore bottoms in the never-ending search for oil.

Besides the petrochemical industries which include the manufacture of synthetic rubber and nylon, the industries in the area produce steel oil cans and barrels and other fabricated iron and steel goods. The lumber industry important before the Civil War is still active and pulpwood industries have been introduced. The area has long grown much rice and rice-processing factories are prosperous. The grasslands of the area are grazed by some 50,000 head of cattle, many of them Brahman Swiss hybrids immune to the warm temperatures and to the stings of the area's swarming mosquitoes (see Cattle).

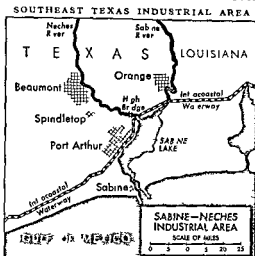
The Story of Beaumont

Orange was settled some time before 1820 and Port Arthur was established by a wealthy and vigorous promoter in 1897. Beaumont was settled in 1825 by Noah Tevis, a Tennessean. By 1830 seven houses and a trading post had been built on the site. Beaumont's first industry was a plant for rendering tallow.

A town plan was made in 1835. By 1840 Beaumont settlers had entered the lumber business. Cotton, cotton and sugar cane were already being raised in the vicinity. Shallow draft schooners and stern wheel river steamers carried the products down the Neches and through Sabine Lake and Sabine Pass to New Orleans and other markets. Before the Civil War rice was experimentally planted.

After the Civil War Beaumont's lumber was in great demand for rebuilding the South. Beaumont's first great fortunes were won in the lumber industry. River traffic dwindled with the coming of the railroads, but rice plantings increased. The United States first rice-polishing mill was built in Beaumont in 1892. By 1900 the wealth of the rice processors rivaled that of the lumber people.

Beaumont's modern importance began in 1901. That year a wildcat well drilled in Spindletop Mound, just south of Beaumont, came in as a gusher that spouted as high as 200 feet. Before the oil flow was controlled at the end of eight days, about 800,000 barrels ran free on the ground. The town then with



The water transport so important to the prosperity of the Sabine-Neches area is shown here. Ocean going vessels can pass under the High Bridge near the mouth of the Neches River.

a population of about 9,500 was quickly overrun by oil prospectors, gamblers and Cajun (Acadian) and Negro workers. More wells were drilled.

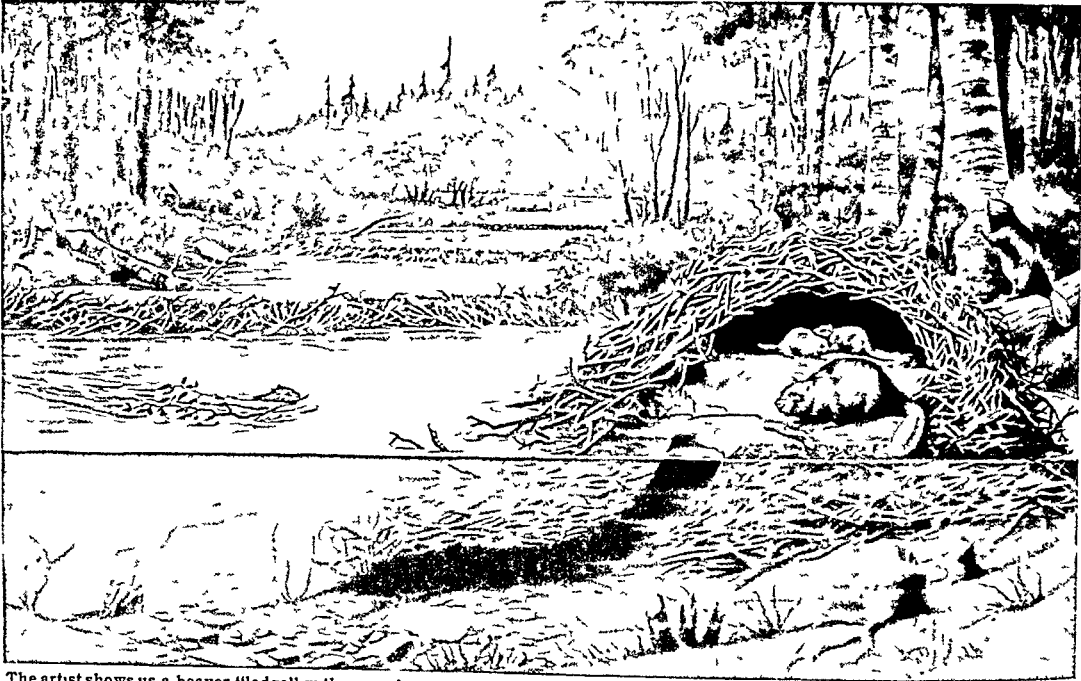
By 1908 in order to increase the transport facilities the Neches channel had been dredged to nine feet. Sabine Pass and the east side of Sabine Lake had been dredged when Port Arthur was established. By 1916 all these channels had been deepened to 25 feet. Now the canalized route to the sea is a minimum of 34 feet deep and 200 feet wide. As the oil from Spindletop dwindled, other fields were tapped. In 1920 deeper drilling brought in new supplies from Spindletop Mound. More than 30 pipelines were laid to fields in Texas, Oklahoma, Louisiana, Arkansas, Kansas and New Mexico. Through these flows petroleum to keep the refineries and petrochemical plants of the Sabine-Neches industrial area busy.

Even before the second World War the area had set up petrochemical plants. During and after the war more such industries were created and built. In 1919 Beaumont discarded the aldermanic form of government for the city manager commission form. (See also Petroleum Texas.) Population (1950 census) 94,014. **BEAVER** Old Indian tales credit beavers with great wisdom. Like men they have developed the art of living and working together. As an aid to their social life they have developed great engineering skill and the special physical equipment that goes with it.

The beaver belongs to the order of rodents or gnawing animals and is the largest of that group in North America. An adult beaver measures from 30 to 45 inches from its nose to the tip of its tail. Its weight is from 35 to 70 pounds. Its coat is composed of long reddish brown outer hairs and a soft brown underfur which keeps it warm.

Like other rodents the beaver is equipped with well developed front teeth set in strong jaws. These

A PICTURE-VISIT TO A BEAVER POND



The artist shows us a beaver "lodge" with one side cut away so that we can see how cleverly it is constructed, both above and below the water line. The floor of the well-kept, neat interior is built on two levels, as a protection in case the water rises during the spring thaw. All the entrances, like the one shown, are designed to be below the thickest ice that may cover the pond in winter. The beaver swimming to the lodge is bringing a green branch to store just outside the underwater doorway. There may be a small hole in the top of the lodge, but enough fresh air filters through the walls. Occasionally beavers keep an air hole open in the ice.

teeth have a very hard layer on the front surface and a softer backing. Since this softer part wears away faster, it always leaves exposed the thin, chisel edge of the front layer. In addition the teeth are always growing to make up for overall wear.

The beaver's hind feet are large, and webbed for swimming. His front feet are small and handlike and are used for picking up and carrying things. The second toe on each hind foot has a double claw for combing his fur. Although slow-moving on land, the beaver is a splendid diver and swimmer, and can remain under water as long as 11 minutes.

The beaver's tail is his most distinctive feature. It is about 10 inches long, broad and flat, and covered with a horny and scaly skin. It serves as a prop when the beaver sits upright and as a rudder and scull when he swims. As a danger signal to other beavers, he slaps it loudly on the surface of the water.

Home Life of the Beaver

A beaver begins life in a litter of "Kittens," usually four in number, and born in April. A mother beaver sometimes will raise more than that number—her own offspring and also the young of another that has died; for beavers always look after the community orphans. Kittens' eyes are open at birth, and by the second week they are able to swim about with their mother. They stay close to her for two years. By the third summer they are mature and ready to begin life in earnest. At this time they take the mate they will

keep for life. If the colony is crowded, a pair may start out, toward the fall of the year, to found a new colony.

The pioneering pair locate a fairly deep, slow-moving forest stream and dig a burrow into the bank, starting below the surface of the water and slanting upward to a small room above the high-water mark. This is only a temporary residence in which the first litter of young will be born. Not until the following autumn does the couple set about building a permanent home. By this time the kittens are able to play by themselves.

Construction of Dam and House

The father and mother first select a narrow, shallow place in the stream as a site for their dam. They gnaw down a number of aspen, birch, or willow saplings, which they drag and float to the chosen spot. There the beavers bury the tips of the branches in the mud, leaving the butt ends pointing upstream. Into this foundation they fit and pile more saplings, adding mud and sometimes stones until a strong barrier is built. It is not completely watertight, and allows enough seepage or overflow to keep the water fresh. Occasionally dams have been found more than 1,000 feet long and higher than a man's head, but these are the work of many generations of beavers. The chief purpose of the dam is to create a pond in which the water level will not change much so that the beaver house can be fitted to it.

THE ORIGINAL AMERICAN LUMBERJACK



Here we see a beaver stripping and eating the bark of a young tree. Perhaps he is doing it to obtain material for the construction of a dam in which he will cut it up in short lengths. Or he may have intended to feed off the tender leaves and twigs at the top of the tree.

This house, or "lodge," consists of a platform of mud and sticks constructed some distance from the bank. When the platform has been built up a few inches above the water, they fashion a dome-shaped roof over it. The house may be woven entirely of sticks or of sticks, brush, and sod combined. Before the coming of winter it is plastered with mud. The room inside may measure ten feet in diameter and three feet in height. Entrances open well under the water, so the beavers may pass in and out under the winter ice.

Beavers feed mainly on the bark of poplar, aspen, willow, and birch trees, and they gather an autumn harvest just as farmers do. When the construction work on their home is finished, whole groves of these trees are cut down, brought to the pond, and sunk to the bottom near the lodge.

Beavers have a reputation for working continually, but actually they are much wiser than that. After an autumn of sustained toil, they spend their winter at rest, swimming out of their warm, dry lodges only to pluck a twig or branch from their storehouse under the ice and returning to munch contentedly inside. In the summer beavers often go exploring and may visit other colonies.

Among themselves beavers are affectionate. When several families live in a colony, the group is friendly and sociable. Taken when young, they make fine pets. Tame beavers are fond of bread, oatmeal, and apples.

Economic Value of the Beaver

The soft, thick underfur of the beaver has long been highly valued by man. During the 17th, 18th, and early 19th centuries beaver skins held first place in the world's fur trade. Warm coats and the tall hats called "beavers" were made from them. Once plentiful throughout the wooded parts of the Northern Hemisphere, beavers were almost exterminated by trappers (see *Furs and Fur Trade*). Today they are strictly protected, and many widely scattered colonies are prospering.

Beavers have been called "the original conservationists." The ponds formed by their dams fill up in the rainy season and give out water slowly during dry weather. Thus they not only check the erosion caused by swollen streams but help to keep water in the stream beds all year, watering both crops and stock.

The scientific name of the North American beaver is *Castor canadensis*. The Old World beaver (*Castor fiber*) was formerly common in England, France, Germany, and elsewhere, but it is now practically unknown except in parts of the Scandinavian peninsula, Germany, and Siberia. The so-called "mountain beaver" (*Aplodontia rufa*) of the Pacific coast ranges belongs to a different family. It resembles a small groundhog.

BECKET, THOMAS (or THOMAS A), ARCHBISHOP OF CANTERBURY (1118?-1170). In the cathedral of Canterbury, England, is a chapel where once stood the shrine of the murdered archbishop Thomas Becket. For centuries after Becket's death countless people—including Geoffrey Chaucer—made pilgrimages to Canterbury "the holy blisful martir for to seke."

The saint at whose shrine the pilgrims worshiped was the son of a French merchant who had settled in London. He studied for the church in both England and Paris and became archdeacon of Canterbury. In 1154 Henry II gave him the important office of chancellor of England. Thomas was tall and handsome. He loved splendid clothes and lavish living. He endeared himself to the king by his love of fun and sport as well as by his ability in war and skill in diplomacy. The two became bosom friends. Soon, however, their friendship turned to the bitterest enmity.

A burning question of the time was whether churchmen should be subject to the king and his courts or only to the pope and the ecclesiastical courts. "Benefit of clergy" extended not only to priests but to many clerks and officials who had obtained minor orders. Many persons who were practically laymen were therefore able to escape due punishment for their crimes, since church law forbade the death penalty. In eight years of Henry's rule, a hundred murders had been committed by persons who claimed benefit of clergy and suffered only light sentences when they were condemned. Henry wanted the lay courts to try clergymen accused of crimes. He objected also to the wide powers exercised by the church over laymen in the matter of wills, inheritance, and similar questions. To further his ends, he decided to appoint his good friend Thomas to the highest church office in England, that of archbishop of Canterbury.

Thomas protested, because he had served under the former archbishop, and he knew that in that office he would be forced to uphold the authority of the church. Henry insisted, and the appointment was made. Thomas at once adopted a life of great austerity and became a zealous churchman. A furious quarrel began. Henry obtained the agreement of the other English bishops to the Constitutions of Clarendon (1164), which severely limited the sphere of church law. Becket rejected the Constitutions and fled to the court of Henry's enemy, the king of France. Henry seized Becket's revenues and exiled his relatives.

After several years a peace was patched up. Becket returned to England in 1170 and at once proceeded to excommunicate the bishops who had done the king's commands while he was away. This fresh act of defiance stung the quick-tempered king to fury. "My subjects are sluggards, men of no spirit," he cried. "They keep no faith with their lord; they allow me to be made the laughingstock of a low-born clerk!"

Four of the king's overzealous knights, hearing these words, hastily crossed the Channel (for the king was in Normandy), proceeded to Canterbury, and killed the archbishop in his own cathedral. This savage deed shocked all the Christian world and was sincerely regretted by Henry himself. Henry was forced by the pope to do bitter penance at Becket's tomb. Becket was declared a saint by Pope Alexander (1172), and his shrine remained the most hallowed spot in England until the Reformation, when it was destroyed by Henry VIII. (See also *Canterbury*; Chaucer; Henry II.)

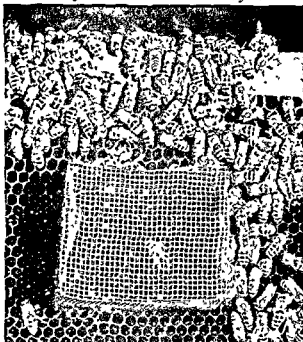
In the Busy WORKSHOP of the BEES

BEE Among the most interesting and certainly the most useful, of all insects are the bees. They are the only insects that man can control and set to work for his own benefit. We think at once of the honey and beeswax they produce. But more important is the work they do in cross pollinating flowers. Without bees our apple, pear, plum, peach, cherry, and other orchards would bear poor fruit or none. There would be no alfalfa or clover. The variety and quantity of most of our vegetables would be greatly reduced.

Plants bear good fruit and seed when the pollen from one flower is carried to the pistil of another flower of the same species (see Flowers). The honeybees and the bumblebees are the most efficient of all pollinizers as they move from blossom to blossom in search of nectar. Many farmers now rent hives from professional beekeepers during the blossoming season. Their crops are two and three times larger than when they depend wholly on wild bees.

Honeybees and bumblebees are called the social bees because they live all their lives in great colonies. A single swarm of honeybees may contain from 10,000 to perhaps 80,000 individuals. All the other families of bees, which nest by themselves, are called solitary bees. Each mother of these species provides a nest for her young. They no longer live together when they have grown to adults.

The honeybees have the most complicated social organization of all the animals, with the exception of the ants. They live in a re-



This colony's own queen failed to return to the hive after her marriage flight and a new queen is provided from another hive. She is kept in this cage for at least 24 hours until the workers become acquainted with her and accept her as their ruler.

public where the citizens do all the governing without voting. Honeybees are perfect socialists. They labor without competition or personal reward, and they have everything in common. They are divided into castes as workers, queens and drones, but these castes exist for the benefit of all, not for their own private advantage. They have many kings but the kings are powerless. Each hive has one queen and it takes wonderful care of her. But she works as hard as any of her subjects and longer.

As architects the bees are not equaled by any member of the animal kingdom except man. A honeycomb is a most marvelous structure. It is

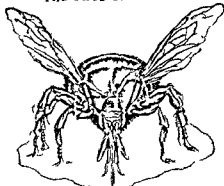
composed of thousands of six-sided cells with walls of wax. In these cells the bees store the honey which feeds the whole colony. In the center of the comb is the royal chamber where the queen and her attendants live. Here are perhaps 10,000 cells in which the eggs lie. Many more thousands are occupied by the lar-

væ and pupæ, all of them cared for by devoted nurses. Here too in the heart of the comb are the rooms, vast in size compared to the others, occupied by the young princesses and their attendants. They will become the queen mothers of other colonies when they have made their marriage flight.

The Females Do the Work

The worker honeybee is an undeveloped female. But her body is changed in many specialized ways so she can carry on the labors of the colony. Her brain is much larger than that of the queen or the drone. She has combs on her hind legs to collect the pollen from

THE FACE OF THE BEE



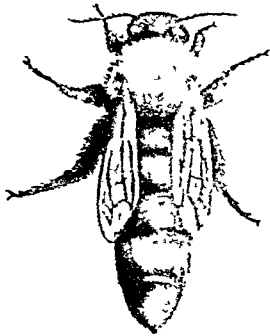
In this highly magnified view of a bee you see how the sensitive feelers grow out of the middle of the face. Beneath the head are the delicate mouth parts making up the proboscis which is usually folded back beneath the head. In the center of the proboscis is the slender grooved tongue with which the bee gathers nectar. It gathers pollen by means of combs on the legs.

flowers and baskets to store it in. She has a system of chemical laboratories within herself; in one she changes the nectar of the flowers to honey. In another she produces food for queens, and in another she changes honey into wax. The duties of the worker bee are many. When she matures she feeds the little bee grubs, or *larvae*, and keeps the hive clean and ventilates it by fanning it with her wings. She learns to build a honeycomb out of wax or to hang up claw in claw with her sisters and gorge with honey in order to give forth little scales of wax from the glands on the

cell walls with a fine silken cocoon, within which it changes to a *pupa*. After gnawing through cocoon and cell cap, the full-grown bee emerges.

During the first three days the little larva is fed royal jelly, a rich creamy food prepared by the nurse bees. The larva actually swims in the milklike substance. The next three days the diet changes in quantity as well as in quality. Beebread, made from pollen, and honey are given in addition to some royal jelly. In six days the larva becomes a pupa. This stage lasts 12 days. The whole development from egg to

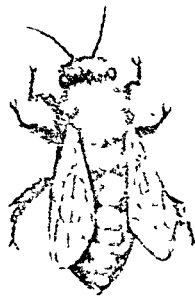
THE THREE CASTES OF BEE SOCIETY



QUEEN



DRONE



WORKER



A WORKER WITH A
POLLEN BASKET ON
ONE HIND LEG

The *queen* is the mother of the colony, and the *drone* is the father. The *workers* are specially developed females. They provide food, and they work as architects and builders, nursemaids and laborers. The pictures show that the castes differ greatly in appearance.

lower side of her abdomen. She gathers nectar from flowers, ripens it into honey, and stores it away in the cells of the honeycomb. She gathers pollen, brings it home in her pollen basket, and then scrapes it off into a cell, where she tamps it down with her head to make it into solid "beebread" to be fed to young bees.

The worker honeybee may be waiting maid to the queen, feeding and caring for her and producing from her own glands the food for the royal mother. She may have to gather bee glue from leaf buds to calk the crevices of the hive, or she may have to hunt a new place for housing a swarm that is soon to come out.

The worker protects the store of honey and defends the colony with her sting, which is located at the rear of the body. It consists of two barbed blades which slide together under a sheathlike covering. At the base of the sting the sheath is enlarged into a bulb. The sheath and the blades combine to form a hollow tube. Poison is forced through it by means of the bulb. When the bee tries to draw out the barbed tip from a victim, the stinger is usually torn from the bee's abdomen. This injury usually kills the worker.

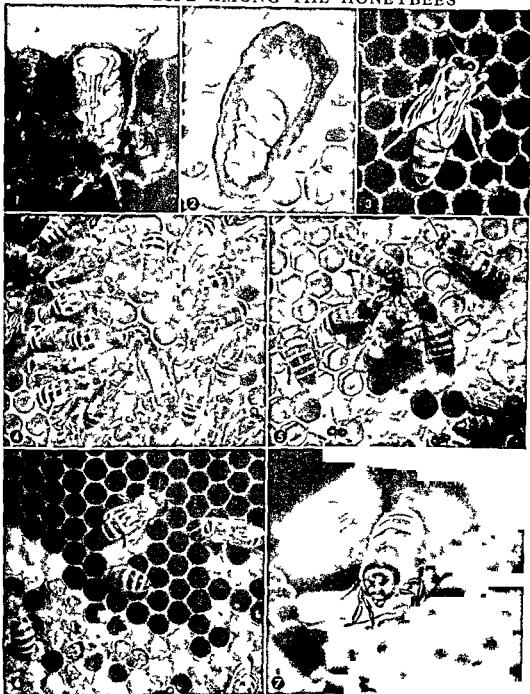
The life story of the bee begins with the tiny white egg that the queen lays in a cell of the honeycomb. The egg stands up straight and is glued at one end to the bottom of the cell. After three days a little white grub hatches from it and is continuously fed by the nurse bees. It grows until it fills almost the entire cell. The bees then cap the cell with a mixture of wax and pollen which is porous enough to allow the air to circulate. Meanwhile the larva lines the

adult lasts 21 days. Adult workers other than the nurse bees live on honey. Nurse bees eat pollen, as well as honey, in order to produce royal jelly and beebread.

The queen lives on royal jelly all her life. During egg-laying it is her only food. At other times she may sip honey occasionally directly from the cells. The queen takes only 16 days to develop. She comes from the same kind of egg as the worker, but she grows in a different cell. It is larger than a worker cell and is attached vertically to the comb. Seven days after the royal cell was sealed a young queen emerges. She starts searching for a rival within the colony. If another queen matured at the same time, the two battle until one is killed, fighting with a royal weapon—a sting curved like a scimitar, which she never uses upon anything or anybody except her own kind.

Five or six days later, when the weather is sunny, the queen will fly from the hive seeking her mate. After mating she returns alone to the hive, capable of laying fertilized or unfertilized eggs at will. The fertilized eggs develop into workers and queens, the unfertilized into drones. She soon commences her great work of egg laying, thrusting her abdomen into cell after cell and leaving an egg on the bottom of each. Just before the height of the honey season she sometimes lays as many as 2,500 eggs a day—twice her own weight. When the honey flow slows down she lays fewer eggs. The number is determined by the workers, who regulate the amount of food given to the queen according to the number of eggs needed. The queen may live five years or longer, while the

DAILY LIFE AMONG THE HONEYBEES



1 A worker bee larva takes form within a cell in the brood comb. 2 The queen larva develops in a peanut-shaped cell. Notice the royal jelly—a gland secretion deposited by the worker bees in the queen cell to nourish the larva. 3 Thus the queen has just emerged from the cell. 4 The queen, identified by her longer body, lays her eggs in the cells, attended by worker bees. Most of the bees face her as human beings would face royalty in a court. 5 Nurse bees feed the larvae of other workers in the cells of the brood comb. 6 The mature worker bees are breaking out of the cell caps, helped by the nurses. 7 A young worker bee cools and ventilates the hive by fanning of the air vigorously with her wings.

worker in the busy season may wear herself out in six weeks.

Bee colonies spread by swarming to remedy an overcrowded condition of the hive. A young queen is reared early in the season. Usually before the young queen emerges from her cell, the old queen, followed by a large number of workers, departs for another abode, which, unless controlled by man, is some place selected by a worker scout. Those left behind are mainly young workers.

The Life of the Drones

The drone or male bee has the least fortunate lot of all the bee citizens. In order that one drone may fulfill his destiny of mating with the queen, many are born only to be slain when the food supply runs low. The luckless drone is denied a share in all activities in the community. He is a clumsy broad blunt-ended bee, fitted for a life of idleness. He has no pollen baskets on his legs, no wax glands in his body; worst of all, he has no sting to protect himself, and his tongue is not long enough to reach nectar in the flowers. But his wings are large and strong, to carry him miles in search of a queen; he has very large eyes—with 8,000 to 10,000 facets—and his antennae are fitted with smelling pores so that he has about 2,600 tiny nostrils wherewith it is said he detects the fragrance of his mistress' royal person.

The drone is reared from an unfertilized egg laid in a cell larger than that of the worker. He spends six days as a larva, 15 days as a pupa. Twenty-four days after the laying of the egg he cuts a lid in the cap which the workers have made over his cell and crawls out, to move about on the comb and to receive food from the workers. After about two weeks he begins making flights, hunting for a queen; but when he finds her his happiness is brief, for he dies immediately after mating. If he finds no queen consort, his lot must puzzle him; for his sister workers, so kind to him always before, harry him fiercely when autumn approaches, deprive him of food, and gradually push him out of the hive to perish.

Not content merely with the riddance of the adult drones, the workers turn upon the drone brood and sometimes upon their own worker larvae and pupae, destroying and killing to reduce the community to safe winter numbers. From 50,000 or more individuals in the summer to 10,000 in the winter is the drastic reduction which occurs in the bee community.

The Harvest of the Hive

A golden harvest comes dripping from the hive of the honey-bee. Production of honey varies from 50,000,000 to 100,000,000 pounds a year, valued at \$6,000,000 to \$12,000,000. Honey is a highly nutritious food. It is composed largely of three nat-

ural sugars—levulose, dextrose, and sucrose (see Sugar). Because it is more easily digested than processed sugars, it is particularly useful in the diet of invalids and children. It is prized as a table delicacy, in home cooking, and in confections. Its soothing qualities make it a common ingredient in cough medicines. To the ancients, honey was almost the only available source of sugar. No finer tribute could be paid to any country in Biblical times than to call it "a land flowing with milk and honey."

Canada and the United States have developed commercial beekeeping, called *apiculture*, to an important extent. The brands of honey take their characteristic flavor or color from the source of the nectar. Honey made from sage is water-white. It is light amber when made from mesquite, white clover, or alfalfa; slightly green, from sweet clover; and dark purple, from buckwheat. The Middle Western states of Iowa, Michigan, Minnesota, and Wisconsin lead in honey production. California, New York, and Texas are heavy producers.

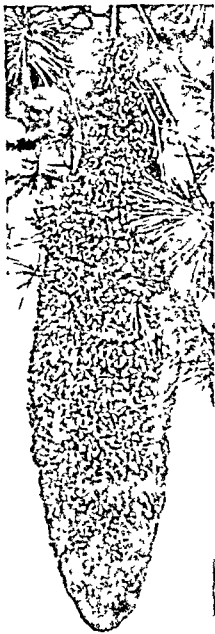
After the storehouses of the bees have been emptied of honey, the walls of the comb are melted down and the resulting product is purified and sold as beeswax. During the second World War it was in great demand as a weatherproof coating for airplanes, shells, and other army equipment. It is an ingredient in adhesive tape, carbon paper, lipstick, face creams, and other cosmetics. It is used in making church candles, phonograph records, wax polishes, and ointments. The dentist makes certain impressions of your teeth in beeswax, and the cobbler waxes his thread with it. Many lifelike models in museums and store windows are made partly from beeswax. But honey and wax, important though they are, are far less valuable to mankind than the bee's work of pollinating food plants.

Honey-Bees from the Old World

There are no honey-bees native to America north of Mexico. Our wild honey-bees are colonies that have escaped from apiaries (places where bees are kept) and have found homes for themselves in hollow trees. The first bees brought over were the German or black bees. The Italian bees, which are more gentle and have longer tongues, have become universal favorites. Caucasian bees and Carniolans are also gentle and have some advocates. Other races like the Cyprians, Syrians, and Egyptians have also been tried but have been found to be undesirable.

The bumblebees are also social, but they have not reached the efficiency of the honey-bee. However, they are very important as pollen carriers for thousands of plants, because they have long tongues and so are able to take nectar from deep flowers which

A SWARM



Somewhere in the center of this living mass of bees is an old queen, driven from the hive by jealousy. Around her, hanging to each other by their claws, are her faithful workers.



to see the actual size

From a painting by Bruno Erta

A BUMBLE BEE OPENS A SNAPDRAGON

The snapdragon's mouth closes tightly over its treasure of nectar, keeping out honey bees and other smaller insects. But the weight of the great bumblebee pulls down the flower's lip and lets the hungry robber climb over and plunge in.

HOW MAN MAKES HONEYBEES WORK FOR HIM



1. A swarm of bees has rushed from its old hive and clustered on a limb of a tree. The new hive has been placed under the limb. 2. The swarm is gently shaken upon a cloth spread in front of the box. The white cloth leads the bees into the entrance. 3. The modern apiary uses movable frame hives similar to these. The queen lives in the lowest section, called the brood chamber. In the upper sections, or supers, the surplus honey is stored. A wire screen prevents the queen from entering the supers and laying eggs but permits the passage of the workers. 4. A beekeeper examines two

frames from the brood chamber. There are usually ten such frames, hung in parallel rows. Two supers are at the right, and in front of them is a smoker. 5. Before he examines the colony, the beekeeper puffs smoke into the hive. Smoke makes a bee fill its honey stomach and so prevents it from doubling its abdomen into the stinging position. 6. The wax caps are cut from the top of the comb with a steam knife. The comb is then placed in the cylinder at the right. A whirling extractor removes the honey from the comb. The combs are further treated to extract and purify the wax.

other insects cannot reach. This fact is important to growers of red clover, for only such long tongued insects as bumblebees can reach the nectar and thus carry the pollen for this important plant. The sight of a bumblebee should warm the heart of every lover of flowers, and bumblebees should be protected.

In early spring we often see a great bumblebee queen or mother flying low over the freshening meadows hunting for the deserted nest of a field mouse or some other suitable cavity for a home. Finding a cozy place, she toils early and late gathering pollen and nectar from all flowers in bloom. This she mixes into an irregular mass of solid "bee-bread," upon which she lays a few eggs gradually adding to the pollen mass until the first brood is hatched.

The little bee grub, as soon as it is hatched, burrows into the bee-bread, making a little cave for itself as it eats. After it is fully grown it spins a silken cocoon about itself, and later comes out a worker bumblebee. She and her sisters at once set about gathering pollen and nectar, thus relieving the queen mother from the work of providing food, so that she can give all her energies to the sole

The queens are the only members of the whole colony of hundreds of workers and drones that are strong enough to stand the cold of winter. Thus each bumblebee colony lasts only for one season, while the honey bees pass the winter in a semi-dormant state.

The hairy body of the bumblebee is of great use in brushing and holding the pollen when she is working on flowers. After she is well powdered she alights on some leaf, and with the most strenuous and comical efforts combs the pollen out of her fur with special combs on her legs and packs it in her pollen baskets on her hind legs.

The Melipones and Trigones of South America also belong to the group of social bees but are stingless and smaller than the others.

Trades among the Bee People

Among the most common of the solitary bees are the carpenters, the leaf cutters, and the miners. The mother carpenter bee bores a tunnel in soft dead wood by cutting out the chips with her jaws. The tunnel leads straight in for a short distance and then downward, and it is just large enough for her to move in comfortably. After the tunnel is completed she gathers pollen and nectar from flowers, and mixes them into a ball. Then she lays an egg upon this pollen mass. Next she gathers some of the chips cut out in making the tunnel and glues them together with saliva, making a little partition above the pollen mass. This acts as a floor for the next cell, in which she places another pollen ball and another egg. She thus makes several cells, in each of which a young bee hatches from the egg and develops to maturity upon



THE CARPENTER BEE'S APARTMENT

The many-storied apartment houses which the Carpenter bees dig in the trunks and branches of trees would look like this if you cut the wood away. On the top floor the mother bee is preparing a mass of bee bread and honey. In this ready to eat loaf she lays her egg and the loaf serves both as a cradle and a pantry for her infant when it hatches. On the floor below is an egg laid perhaps the day before and protected by a partition of chewed up wood pulp as firm as plaster. Below that a grub has hatched out and is eating its bread and honey. On the two lower floors the young bees have reached the chrysalis or "sleeping" stage during which their legs and wings develop. They will soon be ready to come out but will have to wait until the youngest is clear on the top floor matures. Then each tenant will bite a hole in her own ceiling and all will march out at once through the roof and the one that hatched from the first egg laid is always the last one to leave the nest.

duty of laying eggs. These daughters tend the growing family with the most devoted care, and later strengthen the silken cocoon cradles with wax making them into cells in which they store honey. Late in the season a few queens are developed from the eggs laid by the queen, and a few drones to be mates for the queens.

The "bee-bread" she has provided. When they are fully grown each young bee tears down the partition above him, and they all come out into the world in single file, the youngest first.

Not all carpenter bees bore into solid wood, for many species bore out the path in the dead twigs of sumac, elder, raspberry, and other bushes. Some

carpenter bees are leaf cutters also, lining their nests with pieces cut out of leaves, especially rose leaves. They make the partition above the cell with circular pieces cut from the same leaf. Leaf-cutter bees are very clever in saving themselves the trouble of boring out a nest, and often use crevices between the shingles or even the holes in awning rods. Some especially dainty species line their nests with pieces cut from the petals of pansies and other flowers. These carpenter and leaf-cutter bees vary in size from that of a small bumblebee to a tiny creature scarcely a quarter of an inch in length.

The miners bore their tunnels into the ground instead of into wood, and make tiny cells branching off the main tunnel to receive the eggs. The walls of the cells are glazed so that they look like the inside of an earthen jug. In each cell is stored pollen and nectar paste; then an egg is laid and the cell closed until the pupa is grown up and pushes out. While

each mother miner digs her own nest, many of them may live as neighbors in villages. Sometimes a square rod of ground will include thousands of burrows.

Some of the miners are as large as honey bees, but one species of miner is the smallest of all bees—less than a quarter of an inch in length. These tiniest of bees usually mine in the face of cliffs or sandbanks, which look as if they had received a charge from a shotgun.

The carpenter and mining bees do a very important work in carrying pollen from flower to flower in the early spring, thus providing for their reproduction.

Among the solitary bees some called *inquilines* are loafers and get their living from the nests of other bees, just as the cowbird does in the nests of other birds. But no creature can become a parasite without

being punished. These lazy bees have degenerated in form and have lost all power to live independently.

Bees constitute the superfamily Apoidea of the order Hymenoptera, which includes bees, ants, sawflies, wasps, ichneumon flies, and their allies. The hive bees constitute the family Apidae; scientific name of common honeybee, *Apis mellifica*. Bumblebees belong to the family Bombidae. The bee has four wings; the hind pair are smaller. Its

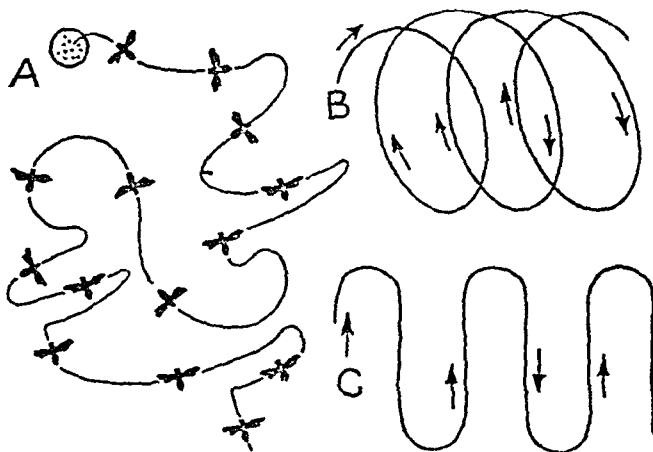
mouth parts are fitted for biting and sucking, and the basal segment of the foot is broadened and fitted for carrying pollen from flowers. The young of all bees are grublike.

BEEBE, CHARLES WILLIAM (born 1877). Many boys read Jules Verne's 'Twenty Thousand Leagues under

the Sea', and Rudyard Kipling's 'Kim'. William Beebe, a naturalist, both read those books and later lived similar high adventures. Beebe earned fame as the explorer who plunged more than 3,000 feet into the ocean in a metal globe called a "bathysphere." There he studied sea life never before observed.

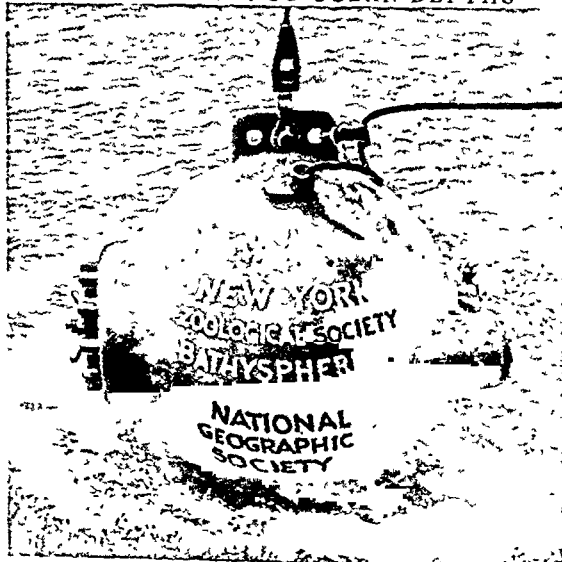
Beebe was born in Brooklyn, N. Y., on July 29, 1877. As a boy he was an avid reader. The semiscientific romances of Verne and the jungle stories of Kipling were among his favorites. After high school he attended Columbia University. He received a bachelor of science degree in 1898, and stayed one

THE LANGUAGE OF THE BEE'S FLIGHT



Every move in a bee's flight has meaning. Here we see (A) the typical course of a bee approaching a blossom. The return to the hive is in a straight "bee line." Back at the hive, the bee performs a dance which tells the others the distance and direction of the food source. The circle dance (B) indicates that the flowers are near by. The wagging dance (C) shows that they are at some distance. The number of circles and turns apparently tells the approximate distance. The position of the dancer's head and body seems to give the direction.

DESCENDING INTO OCEAN DEPTHS



Beebe's bathysphere was 4½ feet in diameter inside. The windows were fused quartz. Telephone wires led to the surface. Lowered by cable from a ship, it enabled Beebe to study underwater life.

BEECH TREE, BEECH LEAVES AND BEECH NUT



At left is a beech tree with its smooth, gray bark. At right are leaves, burrs, and two kernels, on a screen of inch squares to show size.

more year to do postgraduate work. In 1899 the New York Zoological Society named Beebe honorary curator of birds. Later he became director of the department of tropical research. As curator, Beebe helped develop the Zoo's collection of birds into one of the finest in the world.

Beebe's early scientific expeditions led him to such widely separated places as the jungles of Borneo and the Galápagos Islands off the coast of Ecuador. His first expedition was to Mexico with his wife Mary Blair. Next he went to British Guiana where he was director of the research station maintained by the society. In the first World War Beebe served as a flier. Depressed after the war the tall, wiry explorer returned to Guiana. He told of his experiences in 'Jungle Peace,' one of his most popular books.

Beebe's greatest contributions to science were his studies of underwater life (see Eel). In 1929 he built a marine laboratory and home on Nonsuch Island in the Bermudas. Here with his second wife Elswyth Thane a novelist he studied the sea life. In 1930 he made his first descent in a two-ton steel ball called the bathysphere (from *bathos* meaning 'depth'). Four years later, Beebe, with Otis Barton made a deep dive of 3,023 feet. This pioneer dive established a record not broken until after World War II (see Ocean). In 1949 Beebe wrote about his expeditions to the Venezuelan Andes in 'High Jungle.'

BEECH The stately beech tree grows for 50 years before it bears its peculiar pyramid-shaped nuts, but it makes a beautiful shade tree much earlier. The life of the tree is about 250 years.

The American beech (*Fagus americana*) grows to be 80 feet high or more and about 3½ feet in diameter. It has a smooth light-gray bark, a broad rounded

top, and serrated leaves that turn yellow and brown in the fall.

The European beech (*Fagus sylvatica*) often grows 100 feet high or more, and has dark-gray bark and shining leaves which remain on the tree most of the winter. The beautiful beeches of England have long been famous, as are the beech forests of Denmark and Germany. One of the most beautiful varieties is the copper beech, which is native to Europe, distinguished by its red sap and leaves.

Beechnuts like the other "mast" or forest nuts, supply pasturage for deer and swine and boys and girls can testify to the toothsome-ness of the tiny kernels. Beechnut oil is sometimes used in Europe for cooking for making salad dressing and for lighting. The wood is hard for water to penetrate and hence is used in France for making wooden shoes. The wood is also much used for flooring and building timber, and for charcoal, and is distilled to make the finest kind of creosote for medicinal use (see Creosote).

BEECHER, HENRY WARD (1813-1887) As a boy Henry Ward Beecher was shy, backward, and spoke in such a mumble that people could scarcely understand him. Yet he developed into a clergyman who stirred the nation with his powerful sermons and lectures.

He was born June 21, 1813, at Litchfield, Conn. The Beechers were noted for their many marriages and large families. His grandfather had five wives and 12 children. His father, Lyman Beecher, a distinguished theologian, was married three times and had 13 children. Seven sons became clergymen. One daughter, Harriet Beecher Stowe, became a famous novelist. Henry's mother died when he was three, and the boy lived in awe of his aristocratic stepmother.

Lyman Beecher wanted his sons to be ministers also. Henry's heart was set on going to sea, but his father persuaded him to continue with his schooling by telling him he ought to study navigation. Henry went to Mount Pleasant Classical Institute in Amherst, Mass., and later Amherst College. Preaching in vacations, he decided to become a clergyman. He finished his schooling at Lane Theological Seminary, where his father was head.

In 1837 he married Eunice White Bullard. They met when Henry was an Amherst student. They had ten children. From 1837 to 1847 he preached in frontier Indiana, where he served two years at Lawrenceburg.

HENRY WARD BEECHER



Beecher aroused the nation with his sermons and lectures.

and eight at Indianapolis. His reputation as a minister and lecturer spread.

In 1847 Beecher began nearly 40 years of service at the Plymouth Congregational Church in Brooklyn, N. Y. Thousands came on Sunday to hear this short, broad-shouldered man thunder from the pulpit. He discussed important questions of the day and became a leader in the antislavery struggle. In 1863 he lectured in England and won friends for the Union.

Beecher also wrote constantly. He contributed to newspapers and magazines and edited a hymn book and church papers. In

his career he probably spiced public questions with more emotional appeal than any other man of his time. He was active until shortly before his death in 1887.

BEET. It was said of Napoleon that he would go down in history with a sugar beet in one hand and the Code Napoleon in the other. It is true that the great emperor did much to encourage beet-growing, because of England's practical monopoly of the colonies which produced sugar cane; but we are chiefly indebted for our temperate-zone sugar production to the scientists of the 19th century, who developed the beet

from a root producing only seven per cent sugar to one which is almost one-fifth sugar, and who are still working to improve the sugar content by seed selection. This remarkable advance in the last 50 years provides an admirable illustration of what can be done by applying scientific methods to agriculture. (See Sugar.)

Besides the sugar beet, which is usually whitish or yellowish, several other species are cultivated. Of these the garden beet is the best known, with its red root and rather small top. Chard (also called Swiss chard) has tall tops with large succulent leaf stems which are cooked and eaten somewhat like asparagus. Mangels, or "mangel-wurzels," are very large varieties of beet grown for stock feeding. Foliage beets, which have beautifully colored leaves, make excellent borders in garden beds.

The beet (*Beta vulgaris*) belongs to the family *Chenopodiaceae*. It is mostly biennial. It is found growing wild in sandy soil around the Mediterranean, and has been culti-

vated for about 2,000 years. Like all root crops, the beet needs a loose, light, rich soil, which must be in the best condition of tillage.

BEETHOVEN (*bā'tō-vēn*), **LUDWIG VAN** (1770-1827). Suffering and success play equal parts in the life of the great musician Beethoven. The story begins with tears, for at the age of four—to satisfy a selfish father—wearry, hungry, and cold, he was forced to spend hours at the violin and clavier (an early form of the piano). It reaches a double climax in the episode of the memorable concert, when, after the

performance of his two greatest compositions, the total deafness of the great master made it necessary that he be turned to the audience to see the overwhelming storm of applause accorded him. It closes with a great funeral-pageant, in sad contrast to the death-bed scene in which the lonely artist passed away, his longing for intimate companion-ship unsatisfied.

Beethoven was born in Bonn, Germany. His father and grandfather had moved to this city from Antwerp, Belgium, in 1732. At Bonn they were singers with the court band. Beethoven's mother, a German, was a servant at the palace.

Beethoven's family life was miserable. The meagerness of the father's income as a singer and his intemperate habits kept the household always in need. The father planned to make his son a child musician whose concert performances would fill the empty family purse. But with all his faults, the father must be credited with having given his son the best instruction he could procure for him. When 9 years old Ludwig was the pupil of the court organist of Bonn; when 11 he made his first concert tour; when 13 he became assistant court organist.

When Beethoven was but 15, the increasing incompetence of the father and the ill health of the mother made it necessary for him to take entire charge of the large family. In spite of these trying circumstances, the boy made such progress in his art that his friends, impressed by his genius, made it possible for him to take up his residence in Vienna, then the world's musical center, and the city in which he spent the remainder of his life. Here Beethoven's

BEETHOVEN AND THE THUNDER OF THE GUNS



Dread of the deafness which finally afflicted him overshadowed all Beethoven's life. During the siege of Vienna by Napoleon, he retreated to a cellar where he tried to shut out the roar of the guns lest the rolling thunder should destroy his hearing.

brilliant playing of the clavichord (a development of the clavier) at once established him in musical circles and his compositions were eagerly sought by publishers. He soon became the foremost musician of the day.

Ears Deaf to the Music that He Made

These should have been bright years for Beethoven but over all the glory of his success hung the shadow of suffering. In the midst of his triumphs he became totally deaf. With this affliction came periods of intense pain caused by some acute digestive ailment and aggravated by his highly emotional temperament. At such times he was nervous and irritable and days of deep remorse followed. At last Beethoven withdrew from society entirely. His brothers attempted to manage his business affairs, entangled him in law suits and estranged him from his best friends. A nephew who had been left in his care and on whom Beethoven lavished all the affection of his lonely life proved a burden of sorrow and bitterness.

His habits of living like his music knew no rules. When composing he could endure no interruption. He worked in the greatest disorder and oblivious to the passage of time. Unsympathetic housekeepers and landlords caused frequent quarrels and changes of residence. Beethoven never knew the comfort of a real home. He was fond of the country and spent much time in the fields, wandering about singing and muttering to himself. Though below medium height his friends said that in moments of inspiration his diminutive figure seemed to tower to the gigantic

proportion of his mind. A letter attached to his will begged that his doctor acquaint his friends with the physical conditions under which he struggled. He hoped they might forgive his seeming harshness which he declared was partially caused by his hopeless longing for human company and sympathy. His real friends needed no such apology.

Beethoven's Great Accomplishments

Pitiful as Beethoven's isolation was, it seemed a source of inspiration. Composition after composition flowed from his pen. All forms of vocal and instrumental music—from dainty bagatelle to grand symphony—from simple songs to opera oratorio and mass—are included in his works, which total 138. In all these varied forms Beethoven proved his skillful musicianship. His 33 sonatas alone would give him a foremost rank among musicians. He took this old set form for all instrumental music and changed it, making it express a freedom of art unimagined by his predecessors.

It is his symphonies, however, that make him supremely great. Richard Wagner, writing of these nine compositions, says: "He developed the symphony to such a fascinating fullness of form and filled this form with such an unheard-of wealth of enchanting melody that we stand today before the Beethoven symphonies as before the boundary line of an entirely new epoch in the history of art, for with them a phenomenon has appeared in the world with which the art of no time and no nation has had anything even remotely to compare."

INSECT CHAMPIONS in the STRUGGLE for SURVIVAL

BEETLES. Few members of the insect world are better fitted for survival than the beetles. Nearly all of them are covered from head to foot with a strong tough armor plate. In addition to this great advantage they have many other means of defense. Among the beetles are powerful fliers, strong jumpers, climbers and swift runners. Some excel in digging and bring some in swimming and diving.

Beetles live in practically all parts of the world—in the water, in the ground and on the surface of the earth. Some are very useful to man. Some are very harmful. Among the useful kinds are the scavengers and undertakers. Dung beetles roll away manure in small balls and bury it as food for their larvae. Carrion beetles bury the dead bodies of small creatures such as frogs, birds or mice. They lay their eggs in the bodies and the larvae feed on the remains.

Certain beetles live by preying on other insects. The ladybug is the gardener's friend because its larvae devour the aphids which try to devour flowers and vegetables. One kind of ladybug brought from Australia by government experts saved the California citrus fruit trees from the cottony cushion scale (see Ladybug Scale Insects). Most beetles, however, do enormous damage. They feed on every kind of plant and every part of the plant from roots to fruit. They eat stored foods, woods and fabrics.



Dung beetles, also called tumblebugs, may be seen singly or in pairs rolling balls of fresh dung along the ground. They bury the balls. Inside each ball the female lays a single large egg.

Most insects such as the butterflies, dragonflies, moths, bees and wasps have four wings. In the case of the housefly and other true flies, the hind pair of wings has been lost. Among the beetles on the

other hand, something has happened to the front pair: they have turned hard and thick, folding down over the back and forming part of the creature's armor-plate. These front wings, or "wing-covers" as they are called, are not used for flying, but are raised on high to permit the filmy delicate hind wings to spread out when the beetle wants to take an air trip. Then when it alights again, the hind wings fold up, the armored wing-covers fall into place over them, and you would never know that the beetle was ever meant for anything except running, climbing, or swimming.

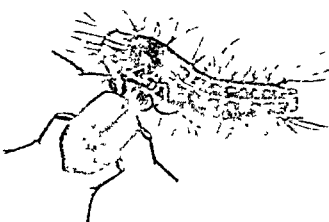
How the Beetles Got Their Name

It is from this peculiarity that the beetles get their scientific name *Coleoptera*, which means "sheath-winged." Another of their qualities is suggested by their English name, which comes from the Anglo-Saxon word *bitel*, meaning "the biting one." Most beetles are indeed great biters, having strong jaws which some use for killing living prey, some for devouring trees and plants, others for gnawing timber, leather, fur, cloth, books, etc., and others for tearing apart the dead things or refuse on which they feed.

In battle, beetles are honest fighters using no stings or poison fangs, but grappling boldly "catch-as-catch-can" with jaws and claws. So, despite the fact that many beetles look fierce and dangerous, you may pick them up without fear, provided you dodge their "pincers" and don't mind the unpleasant smells many of them can create when frightened or angered. For this reason, and also because they are not easily injured by handling, beetles make the most interesting of insect "pets." If they are provided with their natural surroundings and their proper food, most of them quickly adjust themselves to life in a cage and show off their strange habits freely.

Because beetles have so admirably adjusted themselves to nearly all conditions of life, in nearly all parts of the world, the number of their species is believed to be greater than that of any other insect group, with the possible exception of the flies. Scientists have already classified more than 200,000 different kinds of beetles and more are added to the list every year.

THE BEETLE AND THE GIPSY MOTH



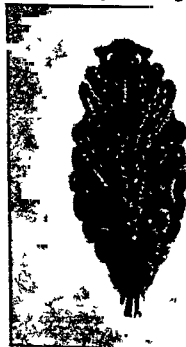
This is the *Calosoma* Beetle that was specially imported from Europe to help get rid of the Gipsy Moth. Here we see him about to dine on a Gipsy Moth caterpillar.



This is a group of the eggs of this beetle. They are buried in the ground. About a week later out come the young larvae, all ready to eat the larvae of the Gipsy Moth.



These are the larvae of the beetle. Just as soon as they emerge from the ground they are able to climb trees and begin attacking the caterpillars that destroy our vegetation.



When full-fed the beetle larvae burrow into the earth and change to pupae, like this one. In a short time they assume the adult form and remain in the ground until the next season.

The life-cycle of all beetles has a complete metamorphosis, that is the beetle egg turns first into a grub or *larra*, then into a *pupa*, then into a full-grown insect (see *Insects*). Beetle larvae, which are usually soft-bodied and often wormlike, with hard heads and strong jaws, are usually very active and often more fierce and greedy than the grown-ups.

The smallest beetles are the "feather-wings," no larger than the head of a pin; the largest are the African "goliaths" and the "elephant-beetles" of the West Indies, which reach six and seven inches in length and are the giants of the insect world. Between these two extremes are found beetles of all shapes and sizes, long and slim, short and fat, and with all the colors of the rainbow. Out of their immense number it will be possible to mention only a few of those which are remarkable for some trick or habit or some curious formation.

A Fierce Hungry Fellow

Perhaps the most interesting and handsome are the "tiger-beetles," wonderfully graceful and active insects with long slender legs for swift running, and colored with brilliant metallic greens and blues, sometimes marked with stripes or spots. They are fierce bloodthirsty creatures an inch or more in length, always on the lookout to pounce on some fellow insect and devour it. The tiger-beetle grubs have a strange way of trapping prey. They lie in holes in the ground, with their large ugly heads blocking the entrance. When an unwary insect steps upon its head, the grub drops suddenly to the bottom of the hole, and the victim tumbles after, to be seized and devoured.

But there's a much smaller beetle called the "bombardier," which has a way of making the hungry "tiger" look very foolish. Just as the latter's jaws are about to close upon it, the bombardier fires a little cloud of acrid irritating vapor from the rear of its abdomen. If once isn't enough to discourage the pursuer, the discharge may be repeated several times in succession, each accompanied by a faint "pop." Thus we see that "poison gas" in warfare is not so novel after all.

The Tumble-Bugs that Sleep with Kings


In contrast to the savage tiger-beetles are those peaceful, lumbering good-

TYPICAL MEMBERS OF THE BEETLE FAMILY

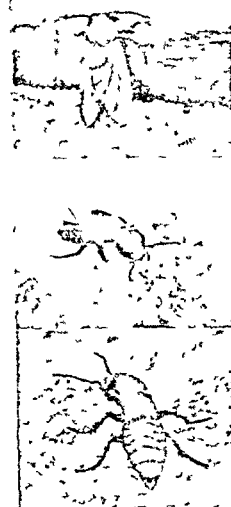


At the top of the picture two wasps (who do not belong to the family) are watching a pair of tumblebugs rolling the ball that contains the eggs. Coming down the tree is a wasp's nest beetle whose young devour the wasp grub. Walking up the tree is a timberman and a larger long horned musk beetle. At the foot of the tree a Hercules beetle is watching a fierce group of golden ground beetles attacking an earthworm. Behind him is an oil beetle. Arriving on the wing at the left is a blister beetle. Below him appears a scarab beetle and beneath him the long horned caliper beetle. The spotted fellow in the middle is the cruel tiger beetle. The big black three horned beetle is next and below are the rhinoceros beetle and the elephant beetle. In the pond are two diving beetles while a third has come out to try his wings.

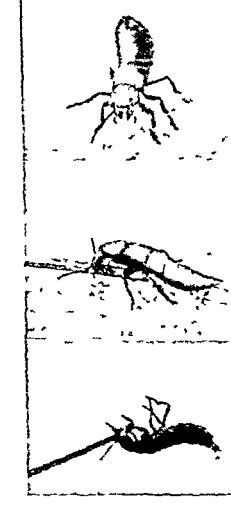
LIFE HISTORY OF THE DEVIL'S COACH-HORSE



This fierce little creature belongs to the Rove-beetle family, distinguished by short wing covers, beneath which the wings are folded with amazing ingenuity. At the top the larva is burrowing in the ground and in the second picture it is enlarging its resting chamber. Next we see it transformed into a pupa, and lying beneath its cast skin. Then the pupa changes into the adult beetle, which crawls out and dries its new wings in the sun. Now it tucks its wings away under the wing-covers, and, in the sixth picture, turns its head quickly as it scents danger. As the enemy draws near, it tries to frighten it away by curling up its tail in the most threatening manner. This is pure bluff, for it has no weapons on its tail, and when the enemy—a bit of straw—comes close, it pounces upon it and seizes it in its jaws. The last picture shows the determined little fighter clinging like a bull-dog, when the straw is lifted.



natured members of the "scarab" family—perhaps the most famous of all the beetles, because their ancestors were held sacred by the ancient Egyptians, who buried them with their mummies and carved rare stones and gems in their likeness.



One of the scarabs, however, wears a clown's costume, and we call it a "tumble-bug" and a "dung-beetle." And a most interesting clown it is, too, as it carves out a mass of dung bigger than itself and rolls it into a perfect ball, then stands on its head with its hind legs up on the ball and pushes it along backwards. Up hill and down it goes, stumbling and kicking, crawling around and under its treasure, lifting it over stones, pulling it out of pits, until it finds a spot to suit it. There a hole is dug and into it the tumble-bug goes with its ball, remaining until it is entirely eaten. The eggs of the tumble-bug are laid in similar balls buried in the ground.

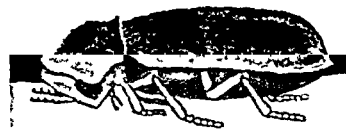
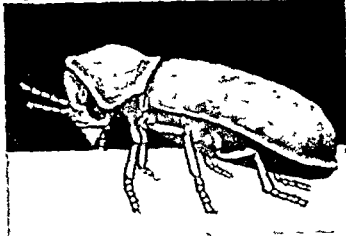
The "tumble-bug," like its cousin the "June Bug" (see June Bug), and many other beetles, has a very hard time getting up if it falls on its back on a smooth

flat surface. There is a group of beetles, however, which has solved this difficulty admirably. They are the "click-beetles," so named because, if they are upset, they double up and then suddenly straighten out with a "click" which tosses them high into the air. Like cats, they usually land on their feet and scurry away. These acrobats are also called "skip-jacks" and "snapping-bugs." Their larvae are the "wire-worms" so destructive to farm and garden crops and fruit trees.

On the whole, the order of beetles is very harmful, for although the tiger-beetles, the ground-beetles, the lady-bugs (see Lady-Bug), and many other varieties destroy enormous numbers of plant-eating insects, and the scavenger and carrion-beetles dispose of a great quantity of decaying matter, there are far more beetles which feed upon trees, plants, fruit, grain, and other valuable foodstuffs. Among the worst offenders are the rose-chafers, the leaf-chafers, nearly all of the long-horned beetles, the dreaded potato-bugs, the tortoise-beetles, the darkling-beetles, the asparagus-beetles, the Japanese beetles, those enemies of timber the engraver-beetles, and, most destructive of all, the countless hordes of snout-beetles or weevils (see Potato-Bug; Weevils).

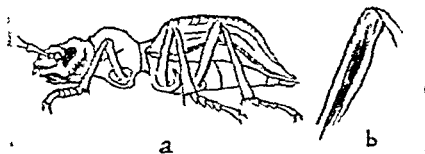
It has been said that there is no animal or vegetable substance that is not preyed upon by some member of the beetle family. As an example of varied diet

THE RAP OF THE DEATH-WATCH



The Death-Watch, instead of trying to frighten people, when he makes that dreaded rap, is signaling to his ladylove. Here we see this beetle much magnified, raising his head, and then bringing it down with a thud.

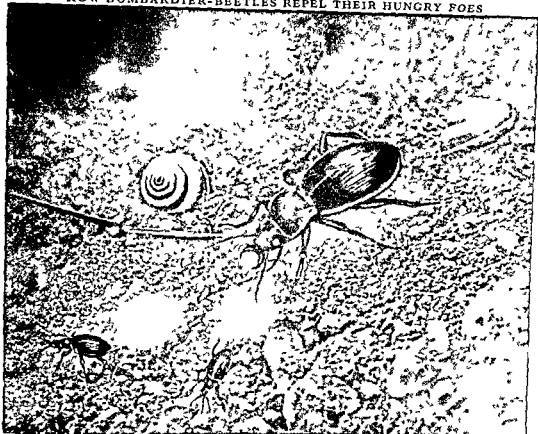
THIS BEETLE PLAYS A FIDDLE



Some Leaf-beetles make sounds by rubbing the row of fine ridges on their wing-covers (a) with another ridged surface on the inside of their hind legs (b).

consider the menu of the tiny "drug-store beetle," which not only eats any form of dry groceries, but delights in such things as red pepper and in at least 45 different drugs, including aconite, belladonna, and

HOW BOMBARDIER-BEETLES REPEL THEIR HUNGRY FOES



This scene—a photograph of a museum group—shows a Tiger beetle pursuing two Bombardier beetles. The smaller insects are armed (as their name implies) to defend themselves against the assault of their enemy. When they are attacked they bombard him by ejecting a foul smelling and irritating gas. This discharge is accompanied by a popping sound. It can be repeated several times in rapid succession. And so the Bombardier beetles usually succeed in driving off attackers.

ergot—all three poisonous to man. Printed books are not too dry for it nor paraffin too oily. A near relative, the "spider beetle," one of the varieties often called "bookworms," has a record of having "penetrated directly through 27 large volumes in so straight a line that a string could be passed through the opening and the whole series of volumes suspended." Another relative the "cigar beetle," dines on cigars, cigarettes, and any form of dried tobacco.

The 'Death-Watch' and His Mysterious Tick

It is to this group of small beetles that the famous "death watch" belongs. Spending its life in tunnels bored in furniture or other household timber, this creature calls to its mate by tapping its head against the sides of its corridors. This faint knocking sound was formerly believed to be a warning of impending death.

Other pests are the *dermestids* or "skin-devouring" beetles, including the 'larder beetle' which feeds on smoked meats, furs, feathers, hair, and horn, the 'leather-beetle' of similar tastes, the "carpet-beetle"

or buffalo moth, which is not a moth at all, but one of the worst foes of carpets and stuffed animals and other museum specimens.

One of the strangest of beetles is the "blister-beetle" sometimes called the 'Spanish fly' for besides the fact that its body contains a substance which is used medicinally for raising blisters on the human skin, it has a most unusual life history. After the larva hatches from the egg, it does not go directly into the pupa form, but passes first through no less than five intermediate larval stages. The wingless "oil-beetles" have a similar experience, which is called by scientists *hypermetamorphosis*.

The Pirates of the Pond

Among the most interesting water beetles are the large predaceous diving beetles, so called because of their fierce and bloodthirsty disposition. Shaped like huge watermelon seeds, their smooth boat-shaped lines and paddle-shaped hind legs make them excellent swimmers, enabling them to capture and devour almost all of the smaller inhabitants of ponds, includ-

ing young fish. When at rest they float head down with the tips of their bodies sticking out of the water. In this way their *spiracles* or breathing tubes, situated at the rear of the abdomen, have access to the air. When they dive they carry down a supply of air beneath their water-tight wing-covers. Their larvae, known as "water-tigers," are even fiercer and hungrier creatures than the adults.

The "water-scavenger" beetles, sometimes one and a half inches long, may also be found in quiet pools, where they clean up decaying plant and animal matter. They carry the air they need for breathing in a thin film spread over the under side of their body, which gives them a silvery appearance when seen from beneath. Unlike the diving beetles they are highly desirable pets for an aquarium, for they keep it clean without molesting the other inmates.

The Funniest Beetles of All

The most amusing of the water-beetles are the "whirligigs," which may be seen on any body of still water dancing in rapid circles over the surface, as though gone mad. If disturbed, they make a queer squeak by rubbing the tip of their abdomen against their wing-covers. These whirligigs have split eyes, the upper half for seeing objects above the surface, the lower half for looking through the water.

A strange family of creatures called "stylops" is sometimes included in the beetle order. Only the male has wings; the female spends her entire life in the body of some other insect such as a wasp, the tip of her body projecting through the segments of her host's abdomen.

No dragons ever invented to frighten children could be stranger in appearance than the monsters of the beetle tribe. The "stag-beetle" with its great hooked mandibles, nearly as long as the insect itself, is perhaps the most startling of northern species, but the tropics have even more remarkable species, such as the "centaur-beetle" with its huge cow-like horns; the five-horned "rhinoceros-beetle"; the "hercules-beetle" with the long wicked-looking projections from its head and back used by the male in carrying its mate; and many others. Curiously enough, these freaks are nearly all the most harmless of all the beetles.

Beetles are not True Bugs

Though many beetles are popularly called "bugs," they should not be confused with the true bugs with sucking beaks, which form a distinct order of insects.

In addition to the hard wing-covers (*elytra*) which distinguish beetles from other insects, they have the first segment of the thorax, the *prothorax*, movable. To this is attached the first pair of legs, the other two pairs being fastened to the second and third segments. In certain of the running beetles the hind wings are reduced to a very small size, useless for flight, or are absent altogether, and in such cases the edges of the wing-covers are often grown together. In other species, such as the "rove-beetles," the wing-covers reach only a short way down the back, leaving the

rear of the abdomen exposed. Beetles' eyes are of the large compound variety; the simple eyes or *ocelli* being very rare among adults, even when existing in the larvae. The *antennae* or feelers are of widely various forms, sometimes broad and short, sometimes twice as long as the beetle's body. They are organs not only of touch, but of smell, and probably of hearing.

Scientific names of best-known beetle families: ground-beetles, *Carabidae*; tiger-beetles, *Cicindelidae*; carrion-beetles, *Silphidae*; rove-beetles, *Staphylinidae*; glowworms, etc., *Lampyridae*; click-beetles, *Elateridae*; water-beetles, *Hydrophilidae*; oil-beetles and blister-beetles, *Meloidae*; stag-beetles, *Lucanidae*; scarab-beetles, *Scarabaeidae*; ladybugs, *Coccinellidae*; weevils, *Curculionidae*.

BEGONIA. This common house plant is cultivated for the beauty of both flowers and foliage. It is easily grown from cuttings taken in the late summer and autumn. The flowers are usually large and showy, some greenhouse varieties reaching four to six inches in length, and vary in color from pink to scarlet and from white to yellow. The fleshy waxy leaves vary considerably, some being large, smooth, and variegated, some hairy and red-tinged. Winged fruit capsules contain minute seeds. The summer-flowering begonia, which produces large single and double flowers, is tuberous rooted, while the winter-flowering variety is fibrous rooted. Two other species are the semi-tuberous begonia, with peltate leaves, and an Asiatic variety, *Begonia rex*, with striking foliage.

The begonia is native to the tropics of both hemispheres, excepting Australia. In North America, it is at its best when grown indoors. Of the 750 species, 150 are cultivated for ornamental use. The flower was named in honor of Michel Begon (1633-1710), a French naval officer and a noted patron of botany. **BELFAST, NORTHERN IRELAND.** The capital and largest city of Northern Ireland and the busiest port in all Ireland, Belfast is situated on the Belfast Lough, a bay of the Irish Sea. It has a large shipbuilding industry, dating from late in the 18th century; and it is the center for the manufacture of fine linens, for which Ireland is famous. Among other important products are textile machinery, clothing, tobacco, rope, beverages, soap, and biscuits. Its trade is carried on chiefly with Liverpool, Glasgow, and other ports of the British Isles.

The people of Belfast are chiefly descendants of Scottish and English colonists of the 17th century. Their faith is overwhelmingly Protestant. The city therefore became the center of opposition to Home Rule and to the Irish independence movement, through fear of religious and economic oppression by the agricultural and Catholic majority of the island.

In appearance Belfast is modern. In the 16th century there was only a little fishing village on the site, and not until the introduction of machine spinning and weaving in the latter part of the 18th century did it begin to thrive. It is the seat of Queen's University and an allied college of technology. Population (1951 census, preliminary), 443,670.

BELGIAN CONGO On both sides of the equator in Africa lies the Belgian Congo. It is one of the richest colonies in the world and belongs to little Belgium. The vast Belgian Congo spreads over some 902,000 square miles—about 77 times as large as Belgium.

The Belgian Congo covers nearly two-thirds of the great basin drained by the Congo River and its tributaries. At its heart a vast rain forest stretches along the upper Congo on either side of the equator. Year-round heat and humidity with 70 inches or more of rainfall in a year make the trees and vines grow in a dense tangle. They quickly choke the garden clearings in the scattered villages. Tribes of pygmies live here by primitive hunting and fishing. Plantations under European management grow tropical crops.

The land rises from the 1,000-foot altitude in the forest to a rim of high plateaus and mountains where the climate is cooler and drier. Across the southern half of the colony stretches a grassy tree-dotted savanna with forests fringing the rivers. This more healthful area supports a larger population. Birds, reptiles, insects, elephants, rhinoceroses, and other wild animals are plentiful in both the rain forest and the savanna (see Africa).

The colony has only a narrow outlet to the sea at the mouth of the Congo. It is bordered on the north and northwest by French Equatorial Africa, on the northeast by the Anglo-Egyptian Sudan, on the east and southeast by lands under British control, and on the southwest by Portuguese Angola. The western tip of the Belgian Congo separates Angola from its territory of Cabinda. Ruanda-Urundi on the east is a Belgian trusteeship under the United Nations. The principal cities of the colony are Léopoldville (the capital), Stanleyville, Matadi, and Elisabethville.

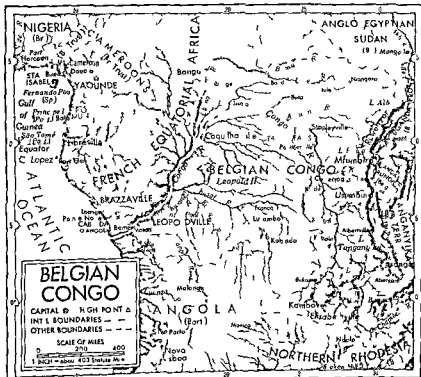
Transportation and communication have been developed by the Belgians. Steamers ply the Congo and its tributaries. Air lines give swift service over the jungles and connect the colony with the outside world.

There are about 56,000 miles of road, 3,100 miles of railway, 4,200 miles of telegraph line, 5,500 miles of telephone line, and numerous radio stations.

Forests and plantations furnish many products for export—palm oil and kernels, cotton, rubber, coffee, sugar, copal, and valuable timber. The mines yield even greater wealth—a large share of the world's copper, industrial diamonds, radium, uranium, tin, and cobalt, along with gold and many other minerals.

The population is 11,870,651 (1952 est.). The Negroes live chiefly by farming or as workers on the great plantations and in the mines. They can with toil the heat better than the white or European people living in the colony.

Belgium acquired this rich colony through the foresight of King Leopold II. When Leopold met the famous explorer Henry M. Stanley in 1877, he saw the importance of the Congo (see Stanley). Leopold seized the vast territory and in 1885 persuaded the European powers to consent to his act. Thus was



The Belgian Congo as this map shows is a vast mountain rimmed basin. Notice how it is drained by the mighty Congo River and its tributaries. These rivers form 8,000 miles of navigable waterways. The many falls are a source of tremendous water power as yet but little utilized.

formed the 'Congo Free State.' Leopold was its absolute ruler. But his rule was marked by accusations that the natives were crushed by taxes and enslaved, and that the guaranteed rights of foreign nations were disregarded. So Leopold in 1908 gave the Congo State to Belgium as the Belgian Congo.

THRIFTY BELGIUM, *Battleground of EUROPE*



This photograph of the port of Antwerp suggests the intense commercial activity carried on against a rich historic background, typical of Belgium. We see an ocean-going steamer moored to the Scheldt River docks, beside which rises the famous Steen Castle, dating back to the 10th century.

BELGIUM. At the crossroads of western Europe live the people of Belgium. Although their land has been a battleground for 20 centuries, they have forged steadily ahead in the arts of peace, and have made their country one of the most highly industrialized in the

world. But side by side with modern factories, mines, docks and canals are preserved beautiful medieval churches and guild halls, and the museums are filled with treasures of Flemish art. Belgium is richer in monuments of medieval architecture than any other region except northern France.

The country is shaped like a triangle. The long base, slanting from northwest to southeast, borders France. The eastern side borders Luxemburg, Germany, and the "panhandle" of Dutch Limburg. The northern side rests against the Netherlands and the North Sea. Student air pilots complain that they have difficulty staying within the boundaries of their country, for its greatest width is only 170 miles. Its area is about equal to that of Maryland, but it has almost four times as many people, making it Europe's most densely populated country except the Netherlands and England.

Northern Belgium is a low plain averaging less than ten feet above sea level. From the latitude of Brussels southward rises a plateau which reaches a height of some 2,000 feet in the rugged wooded hills of the Ardennes region set off by the Meuse, Sambre, and Ourthe rivers.

Extent—North to south, 165 miles, east to west, 170 miles. Area, 11,754 square miles. Population (1947 census), 8,512,195. Colony: Belgian Congo, in Africa, some 900,000 square miles in area; population (1949 est.), 11,121,463.

Natural Features.—Coastal area along North Sea below sea level; northern section a low plain, rising to plateau of the Ardennes Mountains in the southeast. Chief rivers: Scheldt, Meuse, Sambre, and Ourthe. Climate, temperate.

Products.—Coal, iron, zinc, copper, lead; oats, wheat, rye, barley, potatoes, sugar beets, flax, vegetables, fruit, tobacco, hops, livestock, fish, iron and steel bars and castings, machinery, railway locomotives and cars, arms and ammunition, glass, textiles and yarns, lace, paper, brewery products, sugar, furniture, cement.

Principal Cities.—Brussels (capital, 184,838), Antwerp (263,233); Ghent (166,096); Liège (156,203), Ixelles, Anderlecht, Molenbeek-Saint-Jean—suburbs of Brussels (over 60,000).

Credit for the development of this small, meager region into a highly productive agricultural and manufacturing country is due principally to the energy, thrift, and dogged persistence of the Belgian people. Their land is not so fertile as that of many of their neighbors,

but their skill and hard work have given it the highest yield per cultivated acre of the entire world, as well as the highest cash yield per farm worker. Farms are small, averaging less than 12 acres each and most of the farmers rent their land.

Intensive Farming

Like the fields of Holland, those of Belgium bordering the 40-mile coast line are reclaimed from the North Sea by dikes and modern pumping stations, which have largely supplanted the picturesque windmills of earlier times. These polder lands raise grass, barley, and sugar beets, and pasture dairy herds. The sandy wastes back of the coast have been fertilized for centuries and yield rich harvests of wheat, rye, flax, chicory, sugar beets, tobacco, and hops. Fields here are surrounded by trees which break the force of the wind and prevent it from drying out the soil. The loamy, rolling acres of middle Belgium are devoted to general farming, which gives way to truck gardening near Brussels. To the south on the plateau, part of the forest has been cleared. Oats and potatoes thrive here, and the horses bred in this region are world famous. Despite this intensive effort, the country

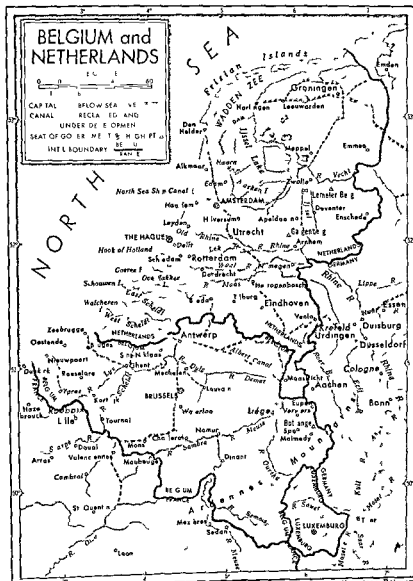
is not able to supply food enough for all its people, and a great part of it, particularly wheat and flour, must be imported

Centuries of Industrial Growth

In industrial development too the Belgians have made the most of what they have. Their resources include deposits of good coking coal, abundant skilled labor, rich markets among their neighbors, excellent facilities for land and water transportation, and one of the finest seaports in the world (Antwerp). Their accomplishments are the more remarkable since their factories have been destroyed again and again by invading armies.

The heavy industry in the Sambre-Meuse Valley was based on the coal, iron, copper, lead, and zinc found here and the additional coal from the Campine district to the north east. But as plant capacity expanded and local ores became scarce, manufacturers turned to other countries for ores. They bring in the raw materials cheaply by water and out of them manufacture products which are exported at a profit. This valley—called the 'workshop of Europe'—is the center of the iron and steel, metallurgical glass, machinery, armament, and chemical industries. The chief mining and manufacturing cities here are Liège, Charleroi, Mons, and Namur, but the basin as a whole is heavily industrialized and densely populated (see Liège). Crude ores from the Belgian Congo are shipped to Olen in the Campine coal field for extraction.

The first industry to bring prosperity to the Belgian people was cloth weaving which flourished during the Middle Ages in the north-western area called



Notice how the land slopes from the heights of the Ardennes Mountains in southeastern Belgium toward the coast of the Netherlands, where the shore lies below sea level and the salt water must be kept out by dikes. The flatness of the land makes it possible to link the rivers to one another with an intricate network of canals which reaches into almost every part of the Low Countries.

Flanders. Flemish weavers were the finest in the world. The wealth that built the beautiful cities of Ghent, Bruges, Louvain, and Ypres came from textiles and commerce (see articles on these cities). Much of the wool spun then came from English sheep. When England built its own textile industry, Flemish weaving declined for a time. Then the enterprising cloth makers turned to linen and later to cotton, and in modern times to rayon. In the early centuries weaving was only a cottage industry, but today virtually all

THE ALBERT CANAL, LINKING LIÉGE TO ANTWERP



This photograph shows a section of the Albert Canal near its eastern end. Built to give the heavy industry of the Meuse Valley a direct water outlet to the sea, the canal was finished in 1939. It was partly destroyed by the retreating Germans in 1944, but was repaired by British and United States engineers so it could carry military supplies for the invasion of Germany.

of the spinning and weaving is done in factories. Ghent, Tournai, and Courtrai are the leading centers. But textile factories have spread all over the Flanders plain, even to rural villages, to take advantage of the large supply of cheap labor. Lacemaking too has become chiefly a factory industry, though some housewives still produce exquisite handmade laces in their homes. The center of woolen manufacture has shifted from Flanders to Verviers, in the extreme east. Malines supplies inexpensive furniture to a large part of Europe. Antwerp is one of the world's greatest diamond-cutting centers. Brussels, the capital and largest commercial city, produces a wide variety of manufactures (see Antwerp; Brussels; Liège; Ghent; Bruges).

Except for coal, Belgium has few minerals. But it obtains many minerals from its vast colony in equatorial Africa, the Congo (see Belgian Congo). This region supplies Belgian industries with diamonds, lead, copper, zinc, and cobalt. It is also one of the world's chief sources of uranium. Limestone quarries in Belgium support a large cement industry.

Commerce and Transportation

Belgium depends heavily upon foreign trade. To feed its dense population it must import large quantities of flour, meat, and butter. To supply its factories it must import iron, copper, flax, cotton, and wool. It pays for its imports by exporting manu-

factured goods, chiefly glass, paper, cement, cotton and rayon yarn and textiles, metal products, and cut diamonds. Most of its trade is with neighboring countries in Europe.

Antwerp, at the mouth of the Scheldt River, is one of the world's busiest ports. It serves not only Belgium but a vast hinterland. The Albert Canal, completed in 1939, provides passage for 2,000-ton barges to travel between Antwerp and Liège. At Liège the canal connects with the Meuse River, which connects with the great inland waterways of northern France (see Meuse River). For its size, Belgium has more miles of navigable rivers and canals than any other country except the Netherlands. No other country has such a dense network of railways. Belgium operates air lines in the vast interior of the Congo as well as in Europe. Its merchant fleet is small.

The Flemings and the Walloons

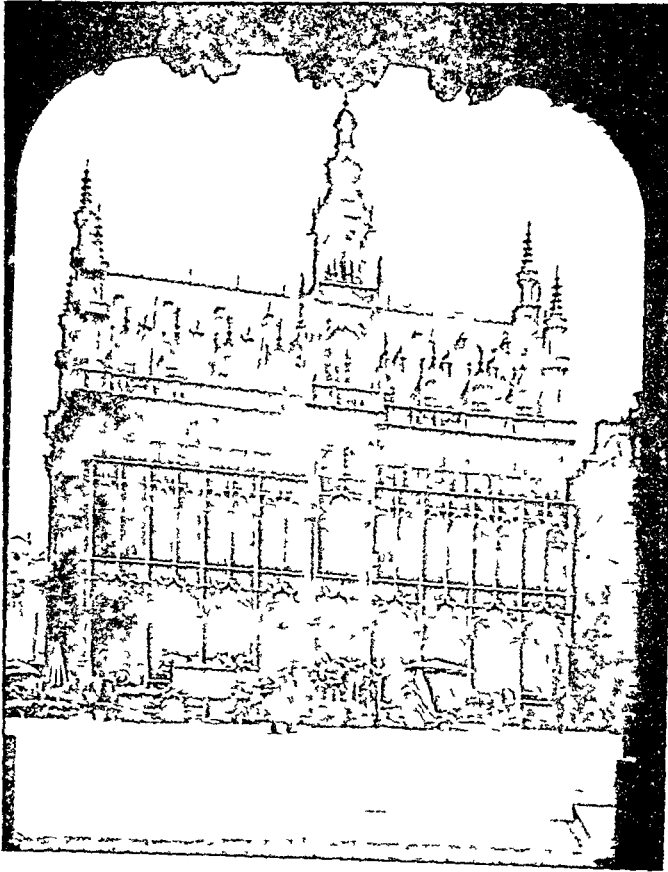
Belgium's oldest problem is the division of the people between two rival groups. Each group is predominantly Roman Catholic. But they speak different languages and live in separate regions. The Flemings speak Flemish, a language similar to Dutch. They live in the low plain called Flanders to the north and west. They are chiefly farmers and textile workers. The Walloons speak French. They live in the highly industrialized highlands to the southeast ("Walloonia"). The Flemings slightly outnumber the

INDUSTRY AND AGRICULTURE IN BELGIUM



Patent hand labor and modern mechanized industry join to produce Belgium's prosperity. 1 We see one of the coal mines that provide fuel for its plant iron and steel furnaces and power for its factories. 2 The acres of geenhouses near Brussels that provide fuel for its plant iron and steel furnaces and power for its factories. 3 A farm family harvests the potato crop which they ripen perfect bunches of early grapes that bring high export prices. 4 A lacemaker of Ghent works in a sunny doorway. 5 Men prepare bundles of flax for retting or soaking in the sluggish waters of the Lys River.

THEY GO BACK TO MEDIEVAL DAYS



Walloons; yet French was long the official language. In 1912 the Flemings won the right to have their language used in schools in Flemish-speaking districts. An act of 1921 extended its use to the local governments and courts of Flanders. Not until 1930 was Flemish made the language of the university at Ghent, "the soul of Flanders."

Education is widespread. Eight years of primary education is free and compulsory. Students who go on to secondary schools pay a fee. The chief institutions of higher learning are the two state universities at Liège and Ghent, the ab-

eral university at Brussels, and the Catholic university at Louvain.

Contributions to Art, Literature, and Science

Flanders has given to the world many famous painters. To the religious art of the 15th century it contributed the brothers Hubert and Jan van Eyck, Hans Memling, Quentin Matsys, and Roger van der Weyden. In the 16th century it produced Jan Mabuse, first of the Italianized Flemings, Hieronymus Bosch, Pieter Breughel the Elder, and Jan Breughel. The 17th century saw the flowering of Flemish art in the exuberant Peter Paul Rubens (*see* Rubens). This century also produced the notable portrait painter Sir Anthony van Dyck (*see* Van Dyck) and the genre painters Jacob Jordaens, Adrian Brouwer, and David Teniers the Younger. The most famous of Belgium's modern painters is James Ensor, who used new and weird color combinations for his mystical subjects (*See also* Painting.)

Literature and science made rapid strides after the Belgians achieved their independence in 1831. Two writers who won world-wide fame were Maurice Maeterlinck, mystic playwright and poet, and Emile Verhaeren, a Flemish lyric poet (*see* Maeterlinck). Both wrote in French. In science, Ernest Solvay



The ornately beautiful Maison du Roi in Brussels (at the top) is typical of the medieval buildings in Belgium's old cities. The photograph was made through the gate of the Hotel de Ville, and shows the flower and vegetable market here. Below, the Ourthe River winds around the village of La Roche in the Ardennes Mountains. The castle on the right may have been built by Pepin the Short.

created the Solvay process of making soda. Leo Baekeland, inventor of bakelite, made his career in the United States.

A Constitutional Monarchy

The government as set forth in the constitution of 1831 is a constitutional monarchy. The crown passes to the descendants of the king in the male line. A chamber of Representatives and a Senate exercise legislative powers. The king, acting on the advice of his cabinet ministers, is the chief executive. The central government appoints the governors of Belgium's provinces and all judges. Small communes numbering more than 2,600 form the basis of the political organization.

These communes evolved from the Middle Ages. Today they are small democracies in which the people take an active part in their local affairs. Women won full suffrage in 1946.

Early History of Belgium

Belgium takes its name from its ancient Celtic inhabitants, the Belgae. Caesar conquered them in seven campaigns, starting in 57 B.C. The conquest brought with it the Latin language, Roman law, and later the Christian faith. In the 5th century of the Christian Era, Germanic people, the Franks, came along the Rhine and settled in the lowland parts of Belgium. This produced a division of the people which has persisted to our day. The Romanized Belgae in southern Belgium became known as Walloons. Descendants of the Franks in the lowland north and west became known as Flemings, and much of the region became known as Flanders.

In 496 the Frankish king Clovis adopted Christianity. He and his successors spread the rule of the Franks over all of western Europe (see Clovis, Charles Martel, Charlemagne). The Frankish empire fell apart after Charlemagne's death (814) and feudalism split Belgium into small principalities. The most important were Flanders, Brabant, Liège, Hainaut, Luxembourg, Namur, and Liège.

In 843 the Treaty of Verdun cut the Belgian land into two parts. Flanders, west of the Scheldt River, went to France. The eastern part passed to the Germanic kingdom of Lotharinga (Lorraine). This division endured for six centuries.

The Middle Ages—Time of the Communes

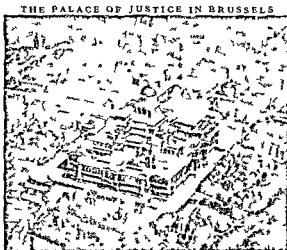
In the Middle Ages, free cities (communes) grew up within the prince's palatines and attained great

wealth and power. Bales of English wool lined the wharves at Ghent and Antwerp. In the great cloth hall at Ypres, merchants from all Europe bought the products of Flemish looms and the handiwork of Flemish lacemakers. The citizens used their wealth to build beautiful churches, town halls, and guild halls (see Guilds). Flemish art was second only to Italian art.

In 1384 Philip the Bold of Burgundy inherited Flanders from his wife's father. During the next century the dukes of Burgundy spread their rule over all of Belgium and the present Netherlands by inheritance and otherwise. In 1477 Charles the Bold was killed, leaving as heir his daughter Mary. She

married Maximilian of Austria and Belgium and the Netherlands passed under Austrian rule. The rule passed to Spain in 1519 when Maximilian's grandson Charles became Holy Roman Emperor and king of Spain (see Charles V).

For nearly two centuries thereafter the combined lands (then called the Spanish Netherlands) were harried by war. Early in Charles's reign the Dutch became Protestants. The Belgians remained Catholic and Spain drew upon them constantly in vain bloody wars against the



This view of Belgium's beautiful capital is dominated by the massive bulk of the Palace of Justice, one of Europe's largest public buildings. The retreat of Germans attempted to burn this magnificent structure in 1944, but their efforts extinguished the flames.

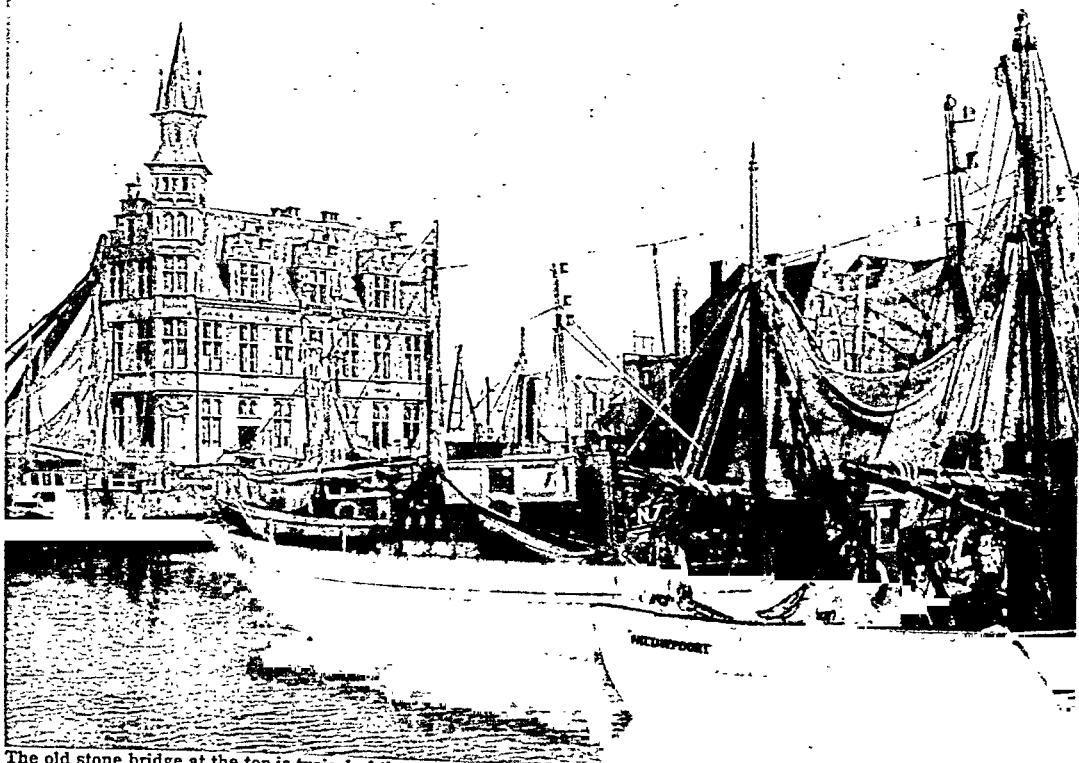
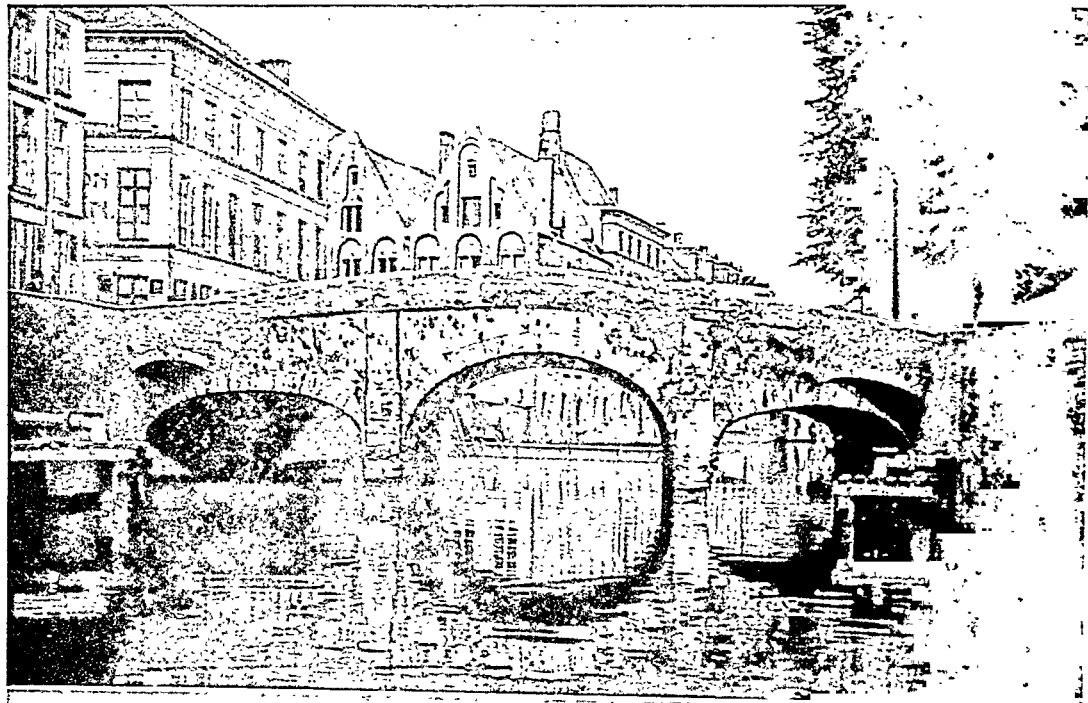
Dutch until Dutch independence was recognized in 1648. Even then Belgium remained the cockpit of Europe, as various wars swept over it. The Treaty of Utrecht awarded the land to Austria in 1713 (see Utrecht). The French annexed it in 1795 and peace was not restored until Napoleon was crushed by the battle of Waterloo fought near Brussels in 1815.

The Belgians Win Independence

After the fall of Napoleon, the Congress of Vienna (1815) joined the Belgians with the Dutch in the Kingdom of the Netherlands. But differences in language and religion divided the Dutch and Belgians. In 1830 the Belgians drove out the Dutch and declared Belgium independent. A National Congress drew up a liberal constitution and elected as king of the Belgians Prince Leopold of Saxe-Coburg-Gotha, uncle of Queen Victoria of England. Belgium dates its independence from the day he ascended the throne, July 21, 1831.

The great powers agreed in 1831 to guarantee the independence of Belgium on condition that it remain a perpetually neutral state. In 1839 Great Britain, France, Prussia, Austria, and Russia signed treaties confirming this agreement.

TWO OF BELGIUM'S FAMOUS OLD CITIES



The old stone bridge at the top is typical of the many spans that give Bruges its name, which means "bridges." Canals like this connect Bruges with near-by Ostend, Zeebrugge, and other towns. Ostend (bottom) is the headquarters of Belgium's fishing fleet. Some of the trawlers are seen here in the harbor. Picturesque old buildings line the shore.

The new state at once entered upon a period of rapid progress. Leopold was an unusually able administrator especially interested in education and science. His son Leopold II who reigned 1865-1909 acquired vast holdings in the Congo and in 1908 turned them over to Belgium as a colony (see Belgian Congo). Belgium profited greatly. Leopold II was succeeded by his nephew Albert I (see Albert I).

Neutral Belgium Drawn Into Two World Wars

Belgium remained at peace 83 years. In 1914 Germany violated its neutrality and overwhelmed it (see World War, First). The four year German occupation left the country devastated. The Commission for Relief headed by Herbert Hoover fed the starving and loans from the United States helped bring back prosperity. The peace treaties turned over to Belgium Dupen and Malmédy on its eastern border. In Africa it obtained a mandate over Ruanda Urundi, a rich cattle country adjoining the Congo. This had been part of German East Africa.

The Treaty of Versailles abrogated the treaty of 1839 and left Belgium free to form alliances. King Albert entered into an alliance with France in 1920 but his son Leopold III came to the throne in 1934 and abandoned the alliance in 1935.

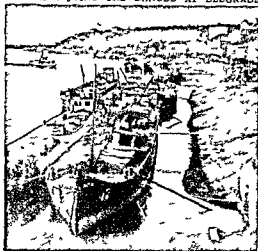
Second World War Engulfs Belgium

At dawn on May 10, 1940 Germany drove a surprise attack into Belgium and the Netherlands (see World War Second). On May 28 the Belgian army was cut off from the British and French and King Leopold III surrendered. The Belgian cabinet fled to Paris and refused approval. Leopold remained in Belgium as a prisoner of war. Belgian patriots resisted the German occupation with sabotage. In reprisal the Nazis deported more than 400,000 Belgians to Germany as prisoners and forced laborers.

On Sept. 3, 1944 the Allies returned and with the help of Belgian resistance forces drove the enemy from the country. The Nazis took Leopold to Austria where he was freed by the American army. His release caused a constitutional crisis in Belgium. The Catholic party favored his return; the Socialists, Communists and members of the former resistance group objected. The king went to Switzerland, practically an exile but stubbornly refused to abdicate. In 1945 the constitution was amended to allow Prince Charles, brother of Leopold, to act as regent.

Belgium suffered little war damage except in Liège and Antwerp. Its industry was disrupted but it made the quickest recovery in Europe. In 1948 Belgium joined the Netherlands and Luxembourg in a customs union called *Benelux*. Belgium then signed the North Atlantic Treaty in 1949. In 1950 about 55 per cent of the nation voted to restore Leopold as king.

THE SAVA JOINS THE DANUBE AT BELGRADE



Here we are looking north along the Sava River from an outlying district of Belgrade. The city proper rises from the high point of land in the background. Behind it is the Danube River. These two rivers carry most of the river trade of the Balkans.

The opposition in parliament refused to take action and the Catholic majority alone restored him. Riots then forced Leopold to say he would abdicate. On July 16, 1931 his son Baudouin I became king.

In 1951 Belgium, with the other nations of Western Europe, started the European Coal and Steel Community, removing trade barriers on coal and steel (see Europe). The Catholic Social Christian party lost control of Belgium's government in 1954 to a coalition of Socialists and Liberals. (For Reference—Outline and Bibliography, see Netherlands.)

BELGRADE (*bel grad*) YUGOSLAVIA. From a long line of quays, Belgrade, capital of Yugoslavia, rises

on a ridge overlooking the juncture of the Danube and the Sava rivers. This command of a great trade route has made Belgrade one of the principal cities of the Balkan Peninsula from its earliest history.

As commerce spread in Europe, hundreds of river craft loaded with goods from central Europe called at Belgrade on their way downstream to the Black Sea and on their voyage back with cargoes from Asia Minor. At Belgrade they loaded grain, tobacco, plums and other fruit from the northern lowlands and the Morava Valley. In due time Belgrade became a rail center and then an important airport. Though its chief business was distribution, Belgrade devel-

oped some light manufactures such as soap, textiles, brewery products, boots, glue, pottery, sugar and some machinery.

A KEY POSITION



Standing at the junction of the Sava and Danube rivers, Belgrade controls the crossroads of the Balkans. Because of this it has been fought over for 2,000 years.

Few cities have seen more masters. Belgrade was founded by the Illyrians more than 2,000 years ago. It fell in turn to the Celts, Romans, Huns, Goths, Franks, Bulgarians, Greeks, Hungarians, Turks, Austrians, and Serbs. The Serbian name *Beograd* means "white castle," from an ancient citadel which guarded a cliff 200 feet above the rivers. In 1878 this city became the capital of Serbia. On July 29, 1914, the first World War started with the Austrian shelling of Belgrade's citadel from across the Danube River.

When Yugoslavia was formed in 1918, Belgrade became its capital. The Yugoslavs modernized the picturesque but squalid old city. They erected many concrete buildings, paved the muddy streets, enlarged Belgrade university, and raised large radio and television stations. During the second World War German forces bombed Belgrade in 1941 and occupied it. In October 1944, Yugoslav partisans and Russian troops liberated it, but much of the city had been destroyed. Population (1953 census, preliminary), 469,988.

BELL. From the early centuries of the Christian Era bells have been rung to mark the divisions of the day, to summon the faithful to prayer, and to announce tidings of joy or sorrow. Bells have sounded the alarm of fire and the tocsin of war, and have given the signal for many a deed of terror. They have pealed in victory and tolled in defeat to mark the closing of wars. We might call them "voices of history."

Some of the bells that rang out in England when the second World War ended are so old that they may also have rung in 1215 to celebrate the signing of the Magna Carta. Some may have tolled the passing of every ruler of England since the death of King John in 1216.

At Eastertide in 1282 the vesper bells of Messina gave the signal for the beginning of one of the worst massacres in history. This slaughter has been known ever since as the "Sicilian Vespers" (see Sicily). And

on St. Bartholomew's Day in 1572, church bells gave the signal for the massacre of thousands of Huguenots in France.

The early Greeks and Romans knew nothing of bells which could be heard throughout a community. Ancient peoples had only small, often square-mouthed, hand bells and closed bells like our sleigh bells. They

hung bells about the necks of sheep and cattle as some people do today. The high priests of the Hebrews wore small tinkling golden bells.

The First Church Bells

By the 5th or 6th century of our era, Christianity had established itself firmly in the Roman Empire, and the Christians used bells in their churches. At first the bells were small. Gradually they became larger and were hung in high towers. From there they could be heard throughout a city. Sometimes these towers were built as part of the church. Often they were separate structures, especially in Italy. There, many bell towers, or campaniles (from the Latin word *campana*, meaning "bell"), were structures of extraordinary beauty. A belfry was originally a tower, often movable, used in warfare. The Old French name was *berfrei*. People later gave the name belfry to watchtowers where alarms were rung and where people might take refuge from approaching enemies. Among the most beautiful of existing bell towers is the campanile of St. Mark's at Venice. This collapsed in 1902 after standing a thousand years. It was rebuilt in 1912. Other famous bell towers are the leaning tower of Pisa and Giotto's campanile at Florence. Modern architects have often copied the tower form developed by the builders of the Middle Ages in designing the towers of skyscrapers.

The earliest bells preserved in the British Isles, like the bell of St. Patrick's at Belfast, may date from the 6th century. These were of the ancient rectangular shape. They were made of thin plates of metal riveted



No skilled performer on a musical instrument ever took more pride in his work than did the bell ringers of England. Dickens immortalized them in his story 'The Chimes'. This old gentleman operates three bells by using one foot and both hands. This method is still a cherished accomplishment in rural England.

together. Gradually men learned the art of casting bells in one piece, and worked out the familiar curving bell-shape which produces the most brilliant tone and the longest vibrations.

THE BELLS OF ST. CLEMENT S



Here is a view inside the tower of the famous bells of St. Clement's in London. Eight of the bells are attached to these wheels you see in the upper room while the ninth the Sanctus bell, is lodged in the steeple.

The process of casting bells is much the same today as it was many centuries ago. A core of bricks is built up and covered with soft clay molded to the outline of the inside of the bell. Then an outer mold or cope of clay is made shaped to the outline of the outer surface of the bell and the molten metal is poured in and left to harden. When the molds are removed the bell may be tuned to the desired tone by taking off thin shavings from the inside.

Metals Used for Bells

From the earliest times—as far back as the days of Nineveh—the metal most used was an alloy of copper and tin in various proportions. Iron and steel were occasionally used but bells so made are much inferior in tone.

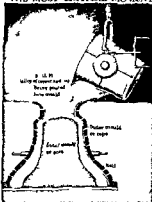
It has long been customary to hang several bells of different pitch together which are made to sound one after the other and thus play simple tunes. These are called a peal of bells or chimes. Each bell was rung by pulling a separate rope. As the number of bells increased from 3 to 8 or even 12 an elaborate art of bell ringing was developed. With three bells only six changes or sequences are possible while eight bells gave the enormous number of 40320 changes. With 12 bells the number is so great that it has been calculated that to ring the changes at the rate of two strokes to the second would require 91 years. Bell ringing became a fascinating popular amusement in England in the 17th century. Societies were formed all over the kingdom which performed wonderful feats of accuracy and endurance in competition. The patterns or tunes were worked out by experts and received many queer names such as Kent treble bob major, Grand sire Triples, Treble bob royal. The art of bell ringing is still practiced with enthusiasm in rural England.

In the United States and the Continental countries especially Belgium chiming is usually done by mechanical devices. Sometimes as many as 60 or 70 bells are thus played by means of a keyboard or levers so that any tune may be played with its accompanying harmonies. In ringing properly so called the bells are swung through a complete revolution resting bottom upward at the end of each swing.

Chiming is the technical term for swinging the bells in their normal position just far enough to be struck by the clapper or for producing tones by striking the stationary bells with small hammers. The latter method is used in all mechanically operated chimes or carillons. These carillons are sometimes played by means of a cylinder just like a barrel organ which is set off at regular intervals by clockwork or by turning a crank by hand.

In this country bells are customarily used only for striking the hours for fire-alarms for special celebrations and for announcing religious services. In the older nations many of the ancient uses still survive. The bell in the parish church sounds the rising signal at five or six o'clock, indicates the time for dinner and sounds the curfew or retiring signal at eight or nine.

THE MOST CRITICAL MOMENT



Casting a bell is a very difficult art, for the slightest flaw such as an air bubble or a tiny crack that comes as the metal cools, may ruin its musical note.

BELLS AND BELL RINGING



1. In this bell factory at Croydon, England, the outer mold is being lowered over the core. 2. Pulling heavy church and tower bells by hand ropes is strenuous and precise work. Here English bell ringers rest a moment. 3. Hand bells "ring in" the Christmas season in the ancient and difficult art of "change ringing." When a given number of bells are rung in order from highest to lowest note, they are said to be rung in "rounds." "Changes" are variations of the order, until, without repetition, the bells come back into rounds. 4. These are the bells used by the Beacon Hill (Boston) hand bell ringers.

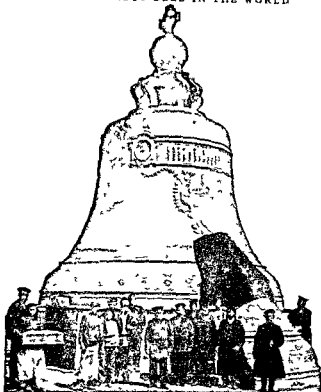
THE LARGEST BELL IN THE WORLD

The curfew (from the French *courre feu*, "cover fire") has rung in many parts of England every night since the time of William the Conqueror. In many places in the United States it was introduced as a signal—say at nine o'clock—when children unaccompanied by adults were required to leave the streets and go home. At Oxford University, 101 strokes are rung on "Great Tom" in Christ Church College at nine o'clock every evening to warn the students to return to their colleges.

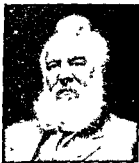
Smaller bells of various shapes are used for an infinite variety of purposes—attached to clocks to sound the hours or to waken us in the morning to summon us to the telephone or announce the presence of a visitor at the door, to call us to meals and to summon servants. Instruments of various bell types are also important members of the modern orchestra (see Musical Instruments).

The Giants among Bells

The largest bell ever cast is the "Zsar Kolokol" at Moscow, which weighed about 200 tons when it was cast in 1733. It has never been rung, however, as it was cracked during the fire of 1737. The great bell is over 21 feet in diameter and stands 19 feet 3 inches high, it now rests on a raised platform, inside the Kremlin walls. Another Moscow bell, the largest in actual use weighs 110 tons. There is a great bell of about 87 tons in a pagoda in Upper Burma, and one of 53 tons at Peking. Besides these monarchs the other famous bells of the world are dwarfed. Great Paul in St. Paul's Cathedral, London, weighs 17 tons, "Big Ben" in the Westminster clock tower of the Houses of Parliament, London, 13½ tons.



The Tsar bell in Moscow is the largest bell in the world. It is 19 feet high, 60 feet in circumference, and weighs 220 tons. The outside is adorned with inscriptions and reliefs. The bell was cast in 1733, but before it left the foundry a fire broke out, and cracked it as you see here, so that its giant voice was never heard.



ALEXANDER GRAHAM BELL
Inventor of the telephone and
friend of the deaf

ried Mabel S. Hubbard, a girl of 18 who had been deaf from early childhood.

During 1874 and 1875 he worked on "the germ of his great invention," suggested by his work with devices

"Great Tom" at Oxford, 7½ tons. The largest bell in America, in Riverside Church, New York City, weighs 25 tons, "swinging weight." The most famous bell of the United States is the Liberty Bell, which rang out the news of the Declaration of Independence in 1776.

BELL, ALEXANDER GRAHAM (1847-1922) Other men before Bell had tried to transmit the human voice across distances and others since have helped improve and perfect Bell's inventions. But Alexander Graham Bell will always be remembered as the father of the first practicable electric telephone (see Telephone).

He was born in Edinburgh, Scotland, on March 3, 1847, and was educated in the Universities of Edinburgh and London. With his father and mother he moved to Brantford, Ontario in

Canada in 1870. His father and grandfather had devoted their lives to the study of human speech and to teaching the deaf and dumb to speak. Alexander Graham Bell followed the profession of his family. Although his fame rests chiefly on the invention of the telephone, his main interest through life was helping the deaf. In 1871, in Boston, he started teaching deaf pupils. The following year he opened a private school to train teachers of the deaf in the methods of "visible speech," which had been devised by his father, Alexander Melville Bell (1819-1905). He began teaching at Boston University in 1873. In July of 1877 he married

to help the deaf. On March 10, 1876, in Boston, the first intelligible sentence was transmitted by telephone. It was spoken by Bell to his assistant: "Mr. Watson, come here; I want you."

Bell applied for a patent on February 14 of that year, just two hours before Elisha Gray filed a notice in the Patent Office covering some of the same principles. At the Centennial Exposition of 1876, in Philadelphia, the demonstrations of Bell's telephone made a great sensation.

Bell became a citizen of the United States in 1882 and served as president of the National Geographic Institution. Among his various inventions was an audiometer, for measuring the intensity of sound. He also experimented in aviation. In 1880 he received the French government's Volta prize of 50,000 francs for his invention of the telephone. He used the money to establish the Volta Laboratory, for industrial research, in Washington, D. C. He later established the Volta Bureau for the Increase and Diffusion of Knowledge Relating to the Deaf.

For many years Bell spent his summers at his estate on Cape Breton Island in Nova Scotia. There he died Aug. 2, 1922, and there his body remained. He was buried on a mountaintop. During the funeral service every telephone of the Bell system was silent. In 1950 Bell was elected to the Hall of Fame at New York University. **BELLEAU (bē-lō') WOOD.** Some 50 miles northeast of Paris, France, stand the battle-scarred trees of Belleau Wood. This was the scene of some of the bitterest fighting of the first World War. The battle of Belleau Wood is one of the most heroic chapters in the history of the United States Marine Corps.

Early in June 1918, the Germans in their advance on Paris had seized the town of Château-Thierry on the Marne River. The Allied troops could not retake this important town without first driving the Germans from the Wood of Belleau about five and a half miles to the northwest. Marine units of the 2d Division were given this critical and difficult assignment. For a brief period they were helped by regular army elements.

The wood was a rock-strewn fortress of German machine-gun nests. Into this inferno the Marines advanced time after time, now being driven back, now gaining a little. Their losses were tremendous. Some companies, reduced to hardly more than a quarter of their original strength, were left in command of a sergeant or corporal. Frequently without water, and without rest for days on end, the Marines fought on. The fighting continued for nearly three weeks until the wood was cleared of the enemy and the battle won. At the north end of Belleau Wood is now situated the Aisne-Marne American Cemetery.

BELLOC, JOSEPH HILAIRE PIERRE (1870-1953). For the first 23 years of his life, this British writer was a citizen of France. Hilaire Belloc was born at Versailles, near Paris. His mother was English and his father French. When Hilaire was two, his father died, and he and his mother moved to Slindon, Sussex, in southern England. There he learned to ride and swim.

In 1883 he entered the Roman Catholic Oratory School at Edgbaston, near Manchester. The other students teased him because he still had French traits, but he won applause for his acting in school plays. He left Edgbaston in 1887. After studying mathematics briefly in Paris, he spent a year on a Sussex farm. In 1890 he traveled to Colorado and California.

Because he was a widow's son, Belloc could have been exempted from the military service required of French citizens when they become 21. But he volunteered as a driver of the Eighth Artillery Regiment, stationed at Toul in northeastern France.

Back in England, Belloc entered Balliol College, Oxford, in 1893. He was Brackenbury History Scholar and president of the Union, the university debating society. He was a popular student leader. After only two years of study, he won first-class honors at his graduation.

He married an American, Elodie Agnes Hogan, in 1896. To support his family, he began writing for London newspapers and magazines. He had already published some historical studies and 'The Bad Child's Book of Beasts', a delightful book of nonsense verses.

In 1903 Belloc became a naturalized British citizen. He entered politics in 1906 as a member of Parliament for Salford. He rebelled against the use of secret party funds in elections and was re-elected as an independent in 1910.

But he left Parliament the same year to fight political abuses. He attacked them in articles in his weekly paper, *The Eye Witness*. He had written satirical novels, 'Mr. Clutterbuck's Election' and 'A Change in the Cabinet'. Now he began writing more serious books, principally on history and biography. His writing became colored by a deep sense of the values of the past, especially those of the religious values before the Protestant Reformation.

Belloc became a good friend of the writer G. K. Chesterton. So close were their ideas that George Bernard Shaw called them "the Chesterbelloc." They stood for Roman Catholicism and conservative social and political ideas. In print and in debate they vigorously and wittily defended their views against those of H. G. Wells and Shaw.

Of Belloc's more than 100 books, some of the best are: *essays*, 'On Nothing' (1908); *history*, 'History of England' (4 vols., 1925-31); *biography*, 'Marie Antoinette' (1909); *novel*, 'Emmanuel Burden' (1904); *travel*, 'The Path to Rome' (1904); and *poetry*, 'Sonnets and Verses' (1944).

HILAIRE BELLOC



He wrote brilliantly in defense of the conservative and traditional values.

THE HINDUS HOLY CITY OF BENARES

BENARES INDIA To Hindus the most holy city in the Indian peninsula is ancient Benares. It lies on the north bank of a great bend of the sacred Ganges River. Millions of Hindus go there every year to visit the shrines and bathe in the purifying waters of the Ganges. Wealthy Hindus build houses here and hope that they will be in Benares when they die for it is said "Happy is the Hindu who dies in Benares for he is transported at once to Siva's heavenly Paradise." Beggars come by the thousands to wheedle alms.

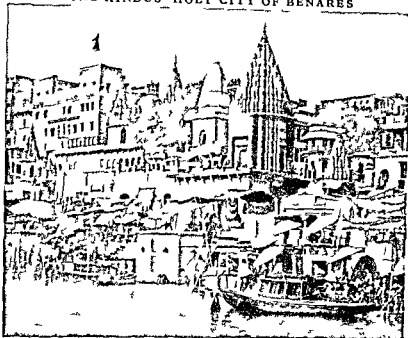
The steep Ganges bank is almost a solid wall of stone steps and landings called *ghats*. The steps lead to temples, great houses and

palaces. Benares has more than 1,500 Hindu temples and many more Hindu shrines. A Mohammedan emperor of India, Aurangzeb, built a great mosque here. And six centuries before the birth of Christ Benares was the home of Buddha. But today Mohammedanism and Buddhism are not important in Benares.

The most venerated Hindu shrine is the small Golden Temple. Its sanctuary is paved with silver rupees (coins) and pilgrims drop flaming camphor-scented leaves on a flower-bedecked image of Siva contained in a deep pit. Every Hindu hopes that before he dies he may walk the 50-mile path that traverses the sacred area. A Hindu who dies here is cremated at the river edge on the Burning Ghat. Another place of special veneration is the well of Mani Karnika. Water from it is said to be sweet from the brow of Vishnu, another Hindu god. A pilgrim who bathes in this well believes he is cleansed from sin for all eternity.

Benares is an important trade center for the fertile Ganges basin. The city was important when Buddha came there, but the present buildings are comparatively modern. Its chief manufactures are brass goods, gold and silver textiles and embroidery, and lacquered toys. Benares College, established in 1791, has a Sanskrit division. Benares Hindu University was established in 1898 as Central Hindu College. Population (1931 census) 355,777.

BENEDICT XV POPE (1854-1922) Under the name Benedict XV, Giacomo della Chiesa was head of the Roman Catholic church between 1914 and 1922. During



At the upper left is the Prince of Delhi's Palace. In the center are temple towers. Below these pilgrims throng the ghats (steps and landings) leading down to the sacred waters of the Ganges River. Every Hindu hopes to bathe in the Ganges before he dies.

the first World War, he kept the Vatican neutral. He tried to persuade the hostile powers to make peace and effected a resumption of official relations between the Holy See and France and England.

Giacomo della Chiesa was born at Pegli, within the Genoa diocese, Nov. 21, 1854. He came of an ancient and noble family that numbered among its members two saints, a cardinal, and several bishops. His father wanted him to be a lawyer, and he took his doctorate in law in 1873 from the University of Genoa.

He then studied for the priesthood at the Collegio Capranica in Rome and was ordained when he was 24. He next attended a school for Vatican diplomats. In 1885 Cardinal Rampolla, newly appointed papal nuncio to Spain, selected Della Chiesa as his secretary. When Cardinal Rampolla became the Vatican secretary of state, Father Della Chiesa remained with him.

In 1907 Father Della Chiesa was created archbishop of Bologna and in May 1914 a cardinal. After the first World War started, he made an address in which he stressed the church's duty to remain neutral to make all efforts to restore peace and to ease the sufferings caused by war. This speech probably influenced his election as pope to succeed Pius X on Sept. 3, 1914.

Pope Benedict XV worked hard and usually read his daily mass before six. By eight o'clock in the morning he was at work. He died Jan. 21, 1922.

Other Pope Benedicts

BENEDICT I reigned between 575 and 579. He died of grief during the Lombard devastation of Italy. Among

the other popes of this name was BENEDICT V, 964–965, who was carried to Germany by Emperor Otto I and died a prisoner there. BENEDICT XIII, the Spaniard Pedro de Luna, was one of the antipopes from 1394 to 1423. He had his see at Avignon in France during the Great Schism. This name was also borne by the canonical pope at Rome, 1724–30. BENEDICT XIV, 1740–58, was renowned for his measures to increase the prosperity of the papal states.

BENGAL. When India was under British rule, the most populous province was Bengal, in the northeast. In 1947 when India was divided into two independent nations, Bengal was also partitioned. East Bengal, where most people were Moslems, went to Pakistan. In its 54,501 square miles are crowded 41,932,329 people (1951 census). Its chief cities are Dacca, capital of East Pakistan, and Chittagong, a port.

West Bengal, mainly Hindu, became a state of India. Cooch Behar joined it in 1950. The area totaled 30,775 square miles and the population 24,810,308 at the 1951 census. It contains Calcutta, with its busy port and extensive jute and steelworks (see Calcutta).

Bengal stretches across the low, fertile Ganges-Brahmaputra delta. Its leading crops are jute, rice, cotton-oil seeds, and sugar cane, with tea in the foothills. The British set up factories in Bengal in 1633. Clive's victory at Plassey (1757) gave the East India Company sovereignty there and marked the beginning of Britain's Indian empire. (See also Clive; India; Pakistan.)

BENTON, THOMAS HART (1782–1858). The West's first great statesman was Thomas Hart Benton. In his 30 years as a Missouri senator, he aided western settlers, fought for a sound money policy, and sought to smooth differences between North and South.

Benton was born, the eldest of eight children, at Hillsboro, N. C., March 14, 1782. His father, a scholarly Englishman, died when the boy was eight. Young Thomas received his early schooling from his mother and attended the University of North Carolina briefly. When he was 17, his mother moved the family to a large land holding near Nashville, Tenn.

Benton studied law. He was admitted to the bar in 1811. As a state legislator he proposed laws to improve the quality of the state's law courts and give Negroes the right to trial by jury. In the War of 1812, Andrew Jackson appointed Benton his aide. In 1813 a duel between Benton's brother and a friend of Jackson's brought about a brawl in which Jackson was wounded. They remained enemies for some years.

In 1815 Benton migrated to St. Louis. He started a newspaper and practised law. He became an authority on involved land titles. Benton was selected as one of Missouri's first senators and took his seat in 1821. Before assuming his duties he married Elizabeth McDowell. They had four daughters and two sons. The eldest daughter, Jessie, eloped with Lieut. John C. Frémont in 1841 (see Frémont).

Benton and Jackson were reconciled, and Benton became a Jacksonian Democrat. He led Jackson's fight against the Bank of the United States (see Banks

and Banking; Jackson, Andrew). He sponsored measures to help settlers obtain government land easily and other legislation to aid settlement of the West. He early proposed building a railroad to the west coast.

Benton disapproved of the measures that brought on the Mexican War, but once war was begun he favored fighting it vigorously. He fought against Calhoun's "nullification" efforts and deplored the Northern and Southern agitation that led to the Civil War (see Calhoun; Webster, Daniel; States' Rights; Missouri Compromise). Although a slaveholder, he did not approve of the extension of slavery, and the slave-holding Missourians feared that he sided with the North. In 1850 he was defeated for re-election. In 1852 he was elected to the House of Representatives but was defeated for re-election. He ran for the governorship of Missouri in 1856, but again was defeated.

Benton's convictions were strong and honest. In the presidential election of 1856, he supported Buchanan instead of his son-in-law, Frémont, the nominee of the new Republican party. In his last years he wrote his 'Thirty Years' View' and edited an abridgment of the congressional debates that had taken place up to 1850. He died April 10, 1858.

BENZENE. One of the most useful products of organic chemistry is benzene. It dissolves gums, resins, fats, and oils. It can be made into many drugs and dyes. In motor fuels, it increases power and helps to prevent motor knocks. It is used in photographic chemicals and in making plastics, synthetic rubber, and many other products.

Benzene is a clear, colorless, inflammable, and highly toxic liquid. It has six carbon atoms, linked in a ring (called the *benzene ring*). Each carbon atom has a hydrogen atom attached. The chemical formula is C_6H_6 (see Chemistry; Hydrocarbons). The hydrogen atoms can be displaced by other atoms or by combinations of atoms. And two or more of the rings can be linked together. Thus chemists form various *aromatic hydrocarbons*, so called because many have a pleasing odor.

Coal tar distilled at about 212° F. yields an impure product called *benzol* (see Coal-Tar Products). Pure benzene is obtained by washing benzol with sulphuric acid, then with caustic soda solution, and redistilling at benzene's boiling point, about 177° F.

Liquid benzene and its vapor are inflammable and poisonous. No flame should be permitted near them. First aid for a victim overcome by benzene fumes consists of removing him into fresh air. A doctor should be called for further treatment.

Michael Faraday discovered benzene in 1825 in an illuminating gas made from fats and oils. In 1845 A. W. von Hofmann obtained benzene from coal tar, and in 1865 F. A. Kekulé worked out the chemical formula and the benzene ring structure. These later discoveries led to the modern uses of benzene.

A substance sometimes confused with benzene is *benzine*, a heavy naphtha obtained from petroleum. It is used to dissolve paints and rubber and in dry cleaning to dissolve fats and oils. It too is inflammable.

BEOWULF (*ba'd-wulf*) The Anglo-Saxon ancestors of the English delighted to hear their minstrels or poets sing of war and deeds of valor, of great heroes and chieftains. When the Anglo-Saxons invaded the British Isles in the 5th and 6th centuries, they brought songs that related the deeds of their hero Beowulf. Later these songs were woven into the great Anglo-Saxon, or Old English, epic "Beowulf."

In the epic the "battle-brave" Beowulf crosses the sea from Geatland (possibly the Sweden of today) to the land of the Danes and frees that country from a terrible ogre, Grendel. In revenge the ogre's mother carries off a king's counselor. Beowulf follows to her lair under the waters of a lake and slays her. Beowulf becomes king of the Geats and rules for half a century. He is fatally wounded when he battles a fire-breathing dragon. Mourned by his subjects, Beowulf is buried under a great barrow, or mound.

"Beowulf" is England's earliest epic poem. Since it was written the language has undergone such change that only scholars of Old English can read the story in the original form. It has been translated into modern English, and anyone interested in heroic adventure can read this translation.

Scholars are not agreed as to just how old "Beowulf" is, nor when it was first put in writing. The only manuscript we have was written in the 10th century. It is now in the British Museum in London.

BERING SEA. "Farthest north" for most navigators on the Pacific side of the world is the Bering Sea. It is important, in spite of remoteness and cold, as the body of water which separates Siberia in Asia from Alaska in North America. The narrowest part is Bering Strait, near the Arctic Circle. It is only 53 miles wide. Within it the boundary between Asia and North America runs between Big and Little Diomed islands, about three and one half miles apart. (For a picture, see ASIA, for a map see ALASKA.)

The sea is largely cut off from the Pacific Ocean by the chain of the Aleutian Islands. Through Bering Strait it opens into the Arctic Ocean. The sea receives a cold current from the Arctic and a warm current from the Pacific. The meeting of the currents causes storms and heavy fogs. Navigation is made dangerous by storm, fog and ice through much of the year. Usually ships enter the sea only from May to October.

Bering has scattered islands. Probably the most important are the Pribilof Islands, because of their great seal rookeries (see SEAL). In the latter part of the 19th century, ruthless hunting threatened to exterminate the animals. In 1881 the United States sought to save them by declaring the Bering Sea a *mare clausum*, or "closed sea"—that is, open to navigation and sealing only under conditions imposed by the United States. An international court of arbitration, in 1893, refused to recognize the United States authority. In 1911 an agreement among Russia, Japan, Great Britain, and the United States was reached, the provisions of which have permitted the seals to increase.

Both the sea and the strait are named for Vitus Bering (or Behring), a Danish explorer in the service of Russia. He made the first systematic exploration of the waters in 1728 and 1741. In the latter year he died on one of the Commander Islands, in the southwestern part of the sea. A Russian, Simon Dezhnev, had sailed in these waters in 1648.

The greatest east-west extent of the sea is about 1,700 miles, from 160° east to 160° west longitude. The area is about 878,000 square miles. Bering Strait and most of the sea are shallow, but the sea deepens toward the south to its greatest known depth, 13,032 feet.

BERKELEY, CALIF. The view of San Francisco Bay from the heights of Berkeley on the eastern shore is truly inspiring. From various vantage points one sees San Francisco across the bay, the breath-taking spans of the great bridges, and the entry to the Pacific Ocean through the Golden Gate. Berkeley's magnificent site slopes down more than 1,000 feet in a series of terraces to a plain at the water's edge.

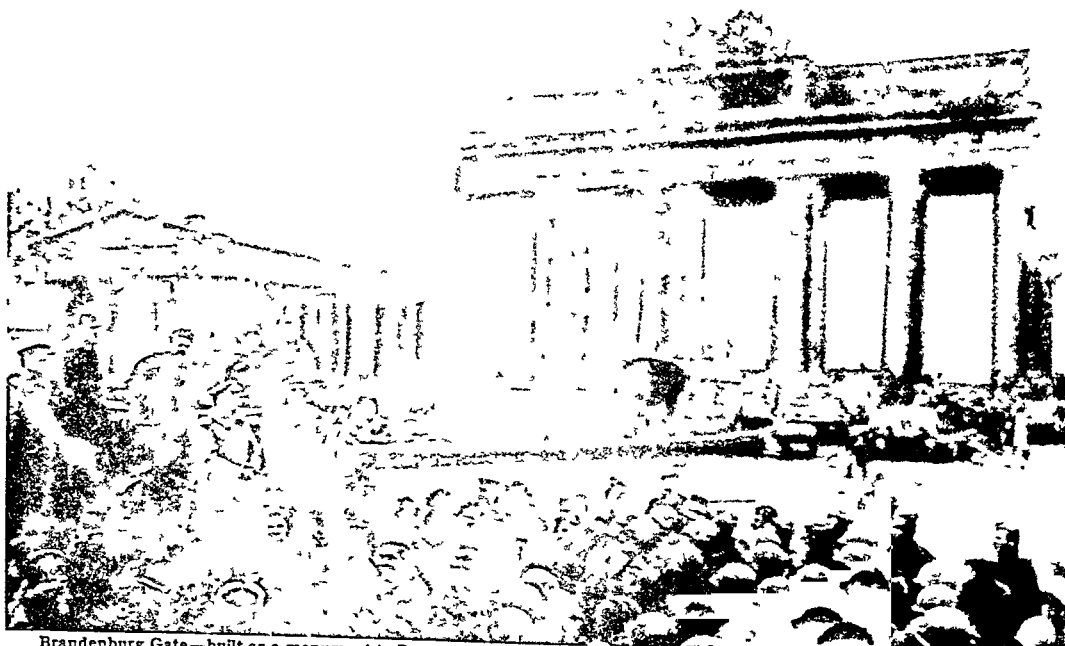
Berkeley's industries early sought the shore line, and many modern factories cling to the location because of its accessibility to rail and water transportation. The higher land has become more thickly settled as families are drawn by Berkeley's many advantages.

Berkeley residents formerly commuted to work in San Francisco on ferries. Some rail travelers from the East also alighted at Berkeley, before the train reached the terminal in Oakland, and ferried to San Francisco. Today commuters board buses that roll over the long stretch of the bay bridge to San Francisco.

An important feature of the city's life is the University of California, one of the world's largest schools, located on the city's eastern heights. It has several outstanding museums, an immense stadium, and many fine buildings. Berkeley also has several divinity schools. The Pacific Institute, an archeological museum of one of these, exhibits discoveries from Palestine dating from 3500 B.C. to the Christian Era. Berkeley has several municipal parks, including the mile-long Aquatic Park, a 1,900-acre regional park adjoins the city.

The Berkeley site was part of the 46,800-acre Rancho San Antonio, a Spanish grant (1820) to the Peralta family. American squatters settled on the ranch in the early 1850's, and in 1853 title to what is now Berkeley was purchased for \$82,000. The university opened in 1869 and the town grew up around it. The city was named for George Berkeley, an 18th-century philosopher and Church of England bishop, who wrote the widely quoted "Westward the course of empire takes its way." The first rail line, from Oakland north to Martinez, reached Berkeley in 1877, and the next year the settlement was incorporated as a village. Berkeley offered refuge to many victims of the San Francisco earthquake and fire of 1906, and many refugees remained to make the city their permanent home. City government is the council manager form. Population (1950 census), 113,805.

The HUGE CAPITAL of the GERMAN NATION



Brandenburg Gate—built as a monument to Prussia's war prowess—was severely damaged during the siege and conquest of Berlin in the second World War. Here Russian officers congratulate their troops in front of the battered symbol of power.

BERLIN, GERMANY. The rapid growth of Berlin paralleled the swift rise of the German nation. Its collapse marked the end of an epoch in Germany's history. Berlin was one of the lesser German cities when it was chosen in 1871 as capital of the newly formed German Empire. By the time the second World War broke out, 68 years later, it was the largest city on the continent of Europe and the fourth largest in the world. Yet at the close of the war this mighty industrial and commercial center lay shattered by bombs and shells, a wasteland of crumbled stone and ashes. With the fall of Berlin, the German Empire, which had evolved into Hitler's "Third Reich," came to an end.

The Pride of Kings and Emperors

Situated in an unproductive region of lakes and rivers, marshes and forests, Berlin owed its rise above all to historical events. It lies in the eastern part of the north German plain, halfway between the Elbe and the Oder rivers. It had its birth in the 13th century as a bridge town on the river Spree. Here the river could be easily spanned because it divided into two arms. On an island between them, to the east of Berlin, grew up a sister town, Kölln. The two cities acquired a small commerce in grain, herring, and timber, and joined the Hanseatic League. In the 15th century Frederick II, elector of Brandenburg, subdued them, and built a fortress on the island of Kölln. His successors put up a palace within the walls. Until the first World War, this palace remained the principal seat of the Hohenzollern dynasty.

As the Hohenzollerns spread their rule from Brandenburg over all of Prussia, they built up and beautified their capital city (see Prussia). In the 17th century the "Great Elector," Frederick William, turned the area in front of the palace into an ornamental square, the Lustgarten. He also laid out a mile-long tree-bordered avenue, Unter den Linden, from the palace eastward across Berlin to the royal hunting grounds, the Tiergarten. His successor, Frederick I, the first king of Prussia, united Berlin with Kölln and the suburbs that had grown up around them, giving the whole municipality the name Berlin. He beautified the palace, kept a splendid court, and put up a number of fine statues and public buildings on Unter den Linden.

In the suburb of Potsdam, to the southwest on the Havel River, Frederick the Great, who came to the throne in 1740, designed and embellished a huge summer palace, Sans Souci ("without care"). On Unter den Linden he put up an Opera House and behind it the Cathedral of St. Hedwig, a reproduction of the Pantheon in Rome. To encourage others to build fine residences he gave them plots of land stipulating that their houses should be well constructed and of harmonious design. His successor, Frederick William II, erected the famous Brandenburg Gate at the entrance to the Tiergarten, which had been turned into a public park. At the eastern end of the famous avenue Frederick William IV put up a great equestrian statue of Frederick the Great in his three-cornered hat. After 1871, when Berlin became the capital of

all Germany, the Hohenzollern emperors followed the example of their ancestors in beautifying the city

Berlin Attracts People from Other Places

In its early days Berlin gathered in people from the northern plain, and its rulers welcomed Protestant refugees from France, Holland, and Bohemia. Later, as the capital of the German Empire the city drew in people from all parts of Germany. From a population of less than 8 000 in the middle of the 17th century it grew to 800 000 in 1870 half the size of Paris. By 1910 it counted 2 million inhabitants. In 1939 Greater Berlin numbered 4 432 000 and covered an area of 341 square miles. During World War II the city lost more than a million inhabitants. Population of West Berlin (1950 census) 2 146 802 of East Berlin (1948 est.) 1 203 833.

As neighboring villages were incorporated into Berlin their forests and fields were turned into parks. Residences spread to the southwest. Academic scientific and military institutions sprang up in the north-west section. Industrial areas ringed the rest of the city to the northeast, east, and south where giant factories surrounded by workers' apartment houses constituted cities within the city. The life of the capital still centered about Unter den Linden, whose ancient linden trees had been replaced by a variety better suited to the sandy soil. Across it from north to south ran Wilhelmstrasse, Berlin's "Downing Street" devoted to government ministries and the long narrow avenue of Friedrichstrasse, lined with fine shops and restaurants.

The Center of Germany's Trade and Industry

West of Berlin the Spree River joins with the Havel which flows in to the Elbe thus giving Berlin an outlet on the North Sea. In the 17th century the "Great Elector" had a canal constructed from the Spree to the Oder River, gaining for the city access to the Baltic Sea as well. Gradually an elaborate system of canals spread over the northern plain. Berlin their focal point, became one of Germany's busiest inland ports, second only to Duisburg-Hamborn on the Rhine.

When railways were built the government routed them through the capital, and Berlin became the hub of a rail network covering all of Germany. Transcontinental lines also were drawn through it—from Paris to Warsaw and Moscow, from the Baltic coast south to Italy, and from German North Sea ports to Odessa on the Black Sea. A circular, or belt, railroad (*Ringbahn*) circled the city, making it

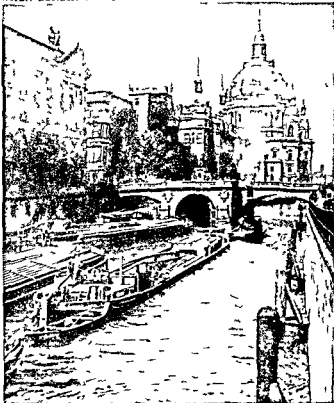
possible to switch freight from one line to another, and a through line (*Stadtbahn*) cut across it from east to west. Hitler built superhighways (*Autobahnen*) converging on the capital, and made Berlin the central point of Germany's widely developed commercial air service.

With unsurpassed transportation facilities and a vast reservoir of labor to draw on, Berlin became the chief manufacturing city of Europe. Remote from the regions that produce raw materials and fuel it specialized in industries that required a high degree of technical skill—electrical appliances and machinery, textiles and clothing, chemicals, furniture, and books. Germany's banking system centered here and the city also contained the country's leading grain exchange.

The Cultural Center of the Empire

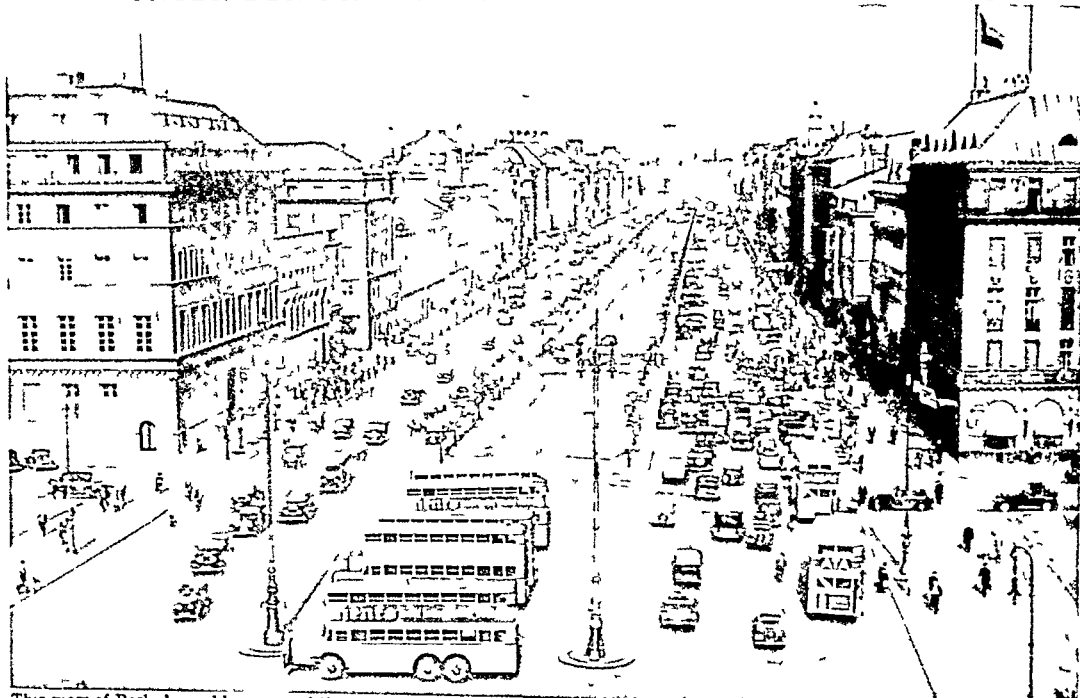
With the city a growing political importance leadership in German culture, which had long centered in southern cities, passed to the capital. The University of Berlin founded in 1809 on Unter den Linden, chose its faculty from among the most eminent scholars of the day and though it was one of the youngest of German universities, it rose quickly to the high-

WHEN BERLIN WAS PROUD OF ITS BEAUTY AND INDUSTRY



This picture taken just before the second World War shows how Berlin combined business and beauty. Barges carried tons of supplies up the river Spree (above), and yet on the banks arose stately buildings like the old imperial palace (left) and the Lutheran Cathedral (background). The Elector's Bridge spanned the river.

"UNTER DEN LINDEN"—BERLIN'S MOST FAMOUS STREET



This view of Berlin's world-renowned thoroughfare—taken before the second World War—looks eastward from the top of the Brandenburg Gate to the old imperial palace. Behind the palace rises the tower of the City Hall. When a subway was dug beneath that central parkway, the original linden trees—for which the street was named "Unter den Linden"—were replaced by younger trees.

est rank. The Prussian State Library, on the same famous thoroughfare, gathered together more than two million books, manuscripts, and musical works. Its building housed also Berlin's famous Academy of Sciences, founded in 1700 by Leibnitz. After the downfall of the empire the royal palace was turned into a museum of industrial arts. German music was fostered in the state Opera House and in numerous concert halls.

Stronghold of the Prussian System

Visitors to Berlin were always impressed by its cleanliness and order. Houses were neat and trim with carefully tended flowers growing in window boxes and on balconies. Streets were tidy and parks immaculate and no one walked on the grass. Pedestrians waited obediently for the light to change before crossing the street. Busses, streetcars, and subway trains ran in accordance with a timetable worked out to the minute. Clocks were visible everywhere enabling Berliners to appear punctually for their appointments. The northern air was stimulating and the people were brisk and alert. One saw no beggars and no wretched poverty.

From its very beginning Berlin was the stronghold of the Prussian military system. The rigid bureaucracy of the *Junkers*, the Prussian aristocracy, imposed on the people the same iron discipline that ruled in the army. The people came to revere duty and order as the highest good. When the empire collapsed, following the first World War, riots and strikes rocked the city. The people showed dissatisfaction with the "weakness" and indecision of the republic that

followed; and when National Socialism came into power in 1933 they welcomed the change. The Hitler dictatorship regulated the most minute details of their daily lives

Hitler's Plans to Transform Berlin

In 1937 Hitler declared: "It is my unalterable determination to ornament Berlin with streets, structures, and public squares . . . that will stand a thousand years, worthy of the immeasurable future of a nation with a thousand years' history." He enlarged the Tempelhof airdrome to be the largest in Europe. He constructed a Reich Sports Field that accommodated 100,000 spectators in the main arena and 200,000 on the May Field. He built Broadcasting House, a vast modernistic structure, and an Air Ministry. On Wilhelmstrasse he put up for his own residence the plain, austere Reichschancellery, and turned Wilhelmplatz in front of it into a spacious assembly ground. Preparations for war soon put a stop to his grandiose program; and the Reichschancellery, which was to be his monument, became his tomb (*see* Hitler).

"Blockbusters" and Incendiaries Devastate the City

During the second World War Berlin was the center from which the Nazis dominated most of Europe. As the political and military capital, the hub of Germany's transportation system, and a center of war industries, it was a vital target for the United Nations. Because of its distance from England it was relatively free from attack until November 1943, when the full weight of long-range bomber attacks began to be felt.

HOW THE SECOND WORLD WAR RUINED BERLIN



1 The battered shells of what were once fashionable apartment houses look out on a rubble filled street. 2. The scarred steps and pillars of the war-ravaged Reichstag (Parliament building) serve as a grandstand for a public meeting. Speakers urge the people not to be entrapped by Communism as they were by the Nazi dictatorship. 3. A Russian officer (left) looks on as two American officers discuss markings of the four occupation sectors held by the British, French, Russian and American armies.

At night Berliners huddled in underground shelters for protection against the swift Mosquito bombers and the heavy Lancasters of the British. Daybreak brought American Flying Fortresses and Liberators. "Blockbuster" and incendiary bombs ravaged Berlin.

On April 21, 1945, the Russians reached Berlin. The city surrendered May 2. Except for the outskirts, Berlin had been bombed and shelled into ruins.

The Allies divided the city into four sectors. Russia occupied and administered almost all the eastern half; France administered a thin wedge of West Berlin; Britain and the United States each governed equal parts of the rest. The entire city, however, was in the Russian occupied zone of Germany, with only an auto highway open to Western Germany.

This lack of transportation enabled Russia to wage another "battle of Berlin," starting June 23, 1948. In the intervening years Russia had turned on its former allies and had begun a "cold war" to force them from Germany (see Germany). Trying to make them retreat from West Berlin, Russia clamped a land blockade on the city. The Allies successfully countered with an air lift that carried even coal and machinery. In 1949 Russia ended the blockade.

By 1953 much of Berlin still lay in ruins, but it became a haven for refugees from the Soviet-occupied sector. East Berlin was the center of anti-Communist riots in East Germany in 1953.

BERLIN, CONGRESS OF (1878). After its overwhelming success in the Russo-Turkish War of 1877-78, Russia imposed on Turkey the Treaty of San Stefano and created a "Big Bulgaria" under Russian protection. Britain feared that Russia might spread

its control to Constantinople (now Istanbul) and the Suez Canal, and joined with Austria in demanding a revised treaty. Weakened by war, Russia consented.

Bismarck, the German chancellor, invited the principal European powers to meet in Berlin in June 1878. The Congress affirmed the principle that the status of the Balkan peoples, who had long been under Turkish rule, was to be decided jointly by the Powers, not by any one of them. "Big Bulgaria" was cut up into three pieces. The independence of Montenegro, Rumania, and Serbia was recognized; and Austria was permitted to occupy Bosnia and Herzegovina.

BERMUDAS. One of the most isolated places in the world, and yet one of the most popular as a tourist resort, is the group of British islands called the Bermudas. They are hardly larger than specks in the Atlantic Ocean, and the nearest land is Cape Hatteras, in North Carolina, about 600 miles west. They can be reached, however, by steamship from New York City in less than two days or by airplane in a few hours. Their delightful climate, beauty, and freedom from noise and dirt attract thousands of visitors each year.

On a map, the Bermudas look somewhat like a fish hook, with the curve at the southwest and the shaft extending northeast. They are nearly surrounded by reefs. There are more than 100 islands, but their total area is only about 19 square miles. The island called Bermuda is larger than all the rest combined.

Only a few of the islands are inhabited. The population, including civilians and British and American defense forces, is 37,403 (1950 census). Of this number about 13,000 are whites. The rest are Negroes,

descendants of slaves freed in 1834. The capital and chief port is Hamilton, on the island of Bermuda. Darrell Island nearby is the terminus for seaplanes. On St. George's Island, at the east end of the group, drowns the picturesque old port of St. George. The group is an important outpost of American defense. It is a British naval station, and the United States has an air and naval base on land leased in 1940.

The average temperature is about 70°F. In winter it is seldom cooler than 55°; in summer, rarely hotter than 87°. The heavy rainfall (nearly 60 inches a year) and brilliant sunshine encourage vegetation. Forests of Bermuda cedar (a species of juniper) cover the low hills. Palms of many kinds, fiddlewood, allspice, and swamp mangrove are other common trees. Hibiscus, oleander, croton, poinsettia, frangipani, and many other flowering plants and trees bloom lavishly. Acres of Easter lilies are cultivated for export and for making perfumery. Farms yield large vegetable crops the year round. About 200 species of birds have been noted, but most of

COUNTLESS ISLETS DOT BERMUDA'S WATERS

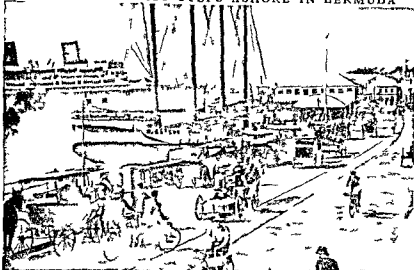


Reefs almost enclose the main island, and islets rise in the sheltered water. Here are some of them, seen from Gibb's Hill, the highest point in Bermuda.

these are migratory birds blown off their regular routes Blue-birds cardinals ground doves white-eyed vireos catbirds and English sparrows are year-round residents The waters teem with fish Many are remarkable for their striking colors and markings—sea horses amber fish groupers and angel fish Tuna bonito and barracuda are the chief game fish

The Bermudas are believed to rest on the peaks of a volcanic mountain which rises steeply from the ocean bottom to about 200 feet below the surface Above

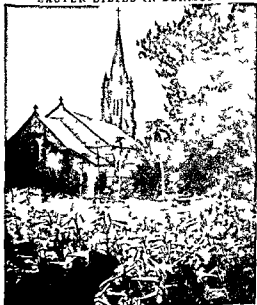
WHERE A TOURIST STEPS ASHORE IN BERMUDA



Hamilton on the main island of Bermuda is the principal port of the island and colony. It is the only place where tourists from the United States, Canada, and Europe dock at its wharves. The island is dotted and almost completely landlocked harbor at Hamilton is one of the most beautiful in the world.

this level the islands consist mainly of limestone formed by sea shells and corals. Along the shore rise huge rocks sculptured by wind and water into fantastic pinnacles pillars and grottoes. The reefs surrounding the islands are being built up by corals—the northernmost point at which this occurs.

EASTER LILIES IN BERMUDA



A field of lilies, a row of papaya trees and a cool stone arch can be made up one of the scenes which draw thousands of tourists to this beautiful island and resort every year.

Coral stone gives the Bermudas excellent roads and building material. The white smooth roads are simply the stone laid bare by stripping a very surface soil or small hills. The stone is so soft that it is cut with handsaws but it hardens with exposure to air. Not only the walls but also the roofs of the houses are built of stone for the roofs are used to catch rainwater which is the chief water supply.

Tourists Support the Colony

In some years more than 75,000 tourists arrive from the United States and Canada visit the islands. The money they spend gives the colony about 80 per cent of its total income. Another source of income is the export of Easter lilies—bulbs and flowers—to the United States, England and South America. Potatoes, tomatoes, carrots, celery and other vegetables are exported for winter sale to Canada and the United States. Meat, flour and most other foods are imported from these countries.

Early in the second World War Bermuda became important as an outpost commanding Atlantic sea lanes. In 1940 President Roosevelt gave Great Britain 50 over-age destroyers in exchange for advanced bases. In 1941 the United States formally took over on a 99-year lease 5½ acres on the Great Sound at the western end of the islands for a base.

One of the special charms of Bermuda before the second World War was the absence of motor traffic. Automobiles were banned and everyone traveled by bicycle, horse-drawn carriage or boat or on the motor-powered railway. The war brought in jeeps, trucks and buses to serve the military bases. In 1944 the assembly voted to lift the ban on private cars and to permit busses, taxicabs and motorcycles to travel the island's roads.

The Bermudas get their name from the Spaniard Juan de Bermudez, who is credited with discovering the islands before 1515. They are also called the Somers Islands, after Sir George Somers, who first settled them early in the 17th century.

Since 1684, the Bermudas have been a crown colony of the British Empire. The legislature consists of a governor, a legislative council, and a house of assembly. The governor is appointed by the crown, as are the nine members of the legislative council. The 36 members of the house of assembly are elected, four from each of the nine parishes. Only property owners may vote.

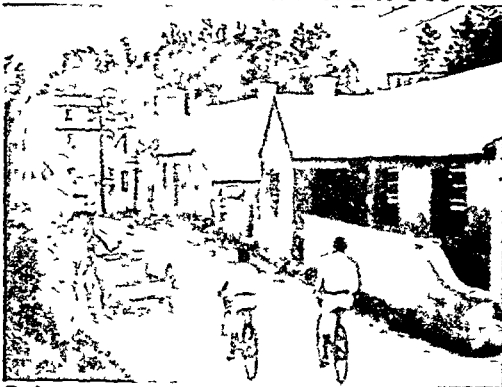
BERN, SWITZERLAND. As the capital of the Swiss Confederation and the headquarters of several international associations, Bern is a city of world importance despite its relatively small population. The beauty of its mountainous surroundings and its many fine old buildings and streets make Bern one of the most attractive and impressive cities of modern Europe.

It stands near the center of the Swiss plateau between the Alps and the Jura Mountains. The older part of the city occupies a high peninsula formed by a loop of the river Aare. Several bridges connect the old town with the newer residential quarters. Public walks have replaced the old fortifications, and afford glorious views of the Alps. Arcades (covered walks) line the streets of the old town, to give sheltering from the weather.

The deep tones of bells, centuries old, draw visitors to Bern's great cathedral, begun in 1421. Almost as impressive is the old Council hall (*Rathaus*), also dating from the Middle Ages. Not far away, a curious old clock tower heralds the striking of the hour with the crowing of a cock and a procession of toy bears. The city is said to take its name from the German word *Bären*, meaning "bears"; hence several fat bears are kept in a pit on the far side of the Aare.

Notable modern buildings are the Federal Houses of Parliament, the University of Bern (founded 1834), and several museums and libraries. Near the Houses of Parliament is the famous monument of the Universal Postal Union, which was organized in Bern in 1874 (for picture, see Postoffice). Among the other international organizations which make Bern their headquarters are those dealing with world problems of telegraph services, railways, and copyrights.

PARADISE OF THE ATLANTIC



Typical of the Bermudas is this scene on tiny Paget Island at the northern end of the chain. Houses are built of native limestone, and the clean white streets are limestone also, made by scraping off the soil from the underlying rock.

An abundant supply of milk from dairy farms near by makes Bern an important producer of chocolate and condensed milk. Other industrial products are machinery and scientific instruments. The Aare has been dammed to generate electricity.

Bern was founded in 1191 as a military post and it entered the Swiss Confederation in 1353. Fire destroyed most of the city in 1405. It became the capital of Switzerland in 1848. It is also the capital of the canton (state) of Bern, which has a population of 801,943 (1950 census).

Population of the city, 146,499.

BERRY, MARTHA McCHESNEY (1866-1942). One Sunday afternoon three ragged mountain boys peered timidly into the log studio where Martha Berry sat reading her Bible. She loved children, and persuaded them to come in. They had a happy visit, listening, while she told story after story.

The next Sunday the boys were back with their sisters and later with their friends. Seeing how much

they and the older mountaineers needed learning, Martha Berry began to teach them reading and crafts. And so started the Berry schools for the underprivileged children of the Georgia mountains.

Martha Berry was born Oct. 7, 1866, on the family plantation near Rome, Georgia. She was educated at fashionable schools in Baltimore and Boston, and traveled in Europe. But the life of a wealthy Southern belle never appealed to her. She preferred to ride her horse up the sparkling stream called Possum Trot to the

cabins tucked away in mountain hollows. In these poor and illiterate people she found eagerness for "book larnin'." They called her the "Sunday Lady of Possum Trot." Encouraged by her Sunday visitors, she determined to open a vocational boarding school on her land.

Growth of the Berry Schools

On Jan. 13, 1902, the first Berry school for the vocational education of mountain boys and girls opened. It had five pupils and two teachers. The only requirement for admission was proof that a child was too poor to attend any other school. To pay their way, the children farmed the land, raised livestock and chickens, and built their own classrooms and dormitories.

When her personal fortune was gone, Miss Berry won the financial aid of Andrew Carnegie, Theodore

MARTHA BERRY



Miss Berry won recognition as one of America's great women.

Roosevelt Henry Ford and R. Fulton Cutting. The school developed into an institution with three units—a foundation school for boys, a school for girls and Berry College—and four branch schools situated in adjacent counties. At the time of her death in 1912 there were 1,200 students and a waiting list of 5,000. The campus covers 35,000 acres of farm land and orchards.

I wanted to teach my children to stand on their own feet in the world. Miss Berry explained. I wanted them to have the independence that comes from knowing how to do things with the hands as well as with the brain. We taught them how to make their homes beautiful without extravagance, how to improve their living conditions, awaken their people from apathy. And they are succeeding well.

In a national poll in 1931 Martha Berry was voted one of the twelve greatest American women. Many other honors came to her for outstanding service to her state and to the nation.

BETEL. A preparation of the nuts of the betel palm (*Areca catechu*) has been the chewing gum of the people of the Orient for at least 2,500 years. Nearly one-tenth of the human family practices betel chewing. In the East Indies, where this drug habit is most general, nearly every native man and woman young and old carries a betel box.

The kernel of the nuts, which are about the size of a small hen's egg, is prepared by boiling, drying and slicing. A small piece is placed on the leathery leaf of a vine belonging to the pepper family (called betel

vine) together with a bit of quicklime and the whole is rolled into a pellet. When chewed the pellets have a sharp stinging peppery taste, color the saliva brick red, stain the gums and lips and blacken the teeth. Many betel chewers are toothless at the age of twenty-five. In India the betel chew is usually called *paan*.

BETHLEHEM. On the crown of a hill in Palestine the hill covered with vines and olive trees slumbers the peaceful little town of Bethlehem, which shares with its near neighbor Jerusalem the distinction of being the most sacred spot in Christendom. At the end of a long straggling street lined with low flat-roofed houses is the shrine to which millions of pilgrims have turned their steps—the magnificent Church of the Nativity erected in 327 over the grotto where Christ is believed to have been born. The nave of this beautiful and interesting church, which monarchs have vied in adorning, is said to be the oldest monument of Christian architecture in the world. In the grotto below a marble trough marks the traditional spot where the manger-cradle stood. A famous altar, called the Altar of the Innocents, marks the reputed burial place of the 7,000 children who according to the New Testament account were slain by Herod.

But even before the birth of Christ, Bethlehem was a place of great fame, for it was the scene of the romance of Ruth and of the death of Rachel. It was also the birthplace of David and in the was annotated king by Samuel. Population 1930 estimated 9,000.

The BIBLE, the WORLD'S BOOK of BOOKS

*How the Marvelous Jewish and Christian Scriptures Have Come to Us
Across the Centuries and Though Written in Ancient Tongues
Still Speak to All the Language of the Soul*

BIBLE. In his cell in a monastery of England more than 1,200 years ago lay the Venerable Bede, the most famous scholar of his day in Western Europe. Feebly he dictated his translation of St. John's Gospel for although desperately ill he would not rest from his labors.

Go on, quickly, he commanded the scribe. I know not how long I shall hold out or how soon my Master will call me hence. All day long they worked and when the rays of the setting sun glided into the quiet room, the task was almost done.



The Venerable Bede dictating the Last Words of St. John's Gospel to the Young Scribe

There remains but one chapter, master, said the anxious scribe. Will you not rest now?

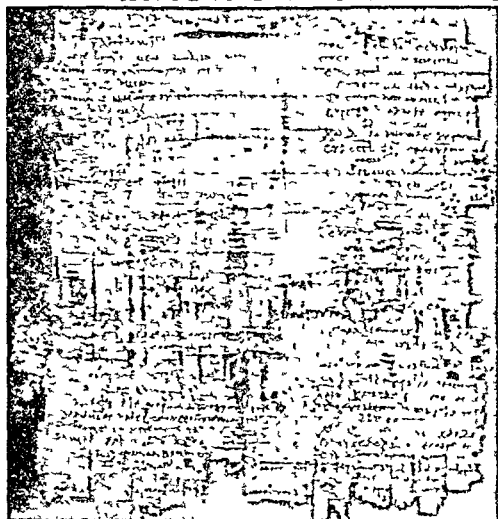
Nay, we must go on, Bede replied. Take up thy pen again and I will translate.

His eyes blinded with tears, the young scribe wrote on. And now, father, said he, as he set down the last sentence from the quivering lips, it is

finished.

Ay, it is finished, echoed the dying Bede. And turning his face to the window where he had so long worked and prayed, he died.

ANCIENT MANUSCRIPTS OF THE BOOK OF BOOKS



On the left is a piece of papyrus containing part of the Twelfth Psalm in Greek translation. This is one of the earliest existing manuscripts of any portion of the Bible. On the right is a page from the treasured Codex Sinaiticus, a 4th-century Greek manuscript on vellum, in the British Museum. The pages of this manuscript were found in a monastery near Mount Sinai in 1844 and 1859.

This saintly scholar is only one of the many great men who have given their lives that the world might have the Bible, the sacred book of Christianity. This great book has woven itself into the very life of the Christian peoples. Translated into Latin, its lessons were the basis of all the church services of the Middle Ages. That its message might be available for the pagan Teutons and Slavs, Ufilas devised the Gothic alphabet and Cyril the Russian. An English translation of the Bible, the Geneva Bible, was carried by the Pilgrims when they set sail for America to find "freedom to worship God" in their own way. It has been on every battlefield since the printing press made it available to all. Explorers have carried it into the frozen North and into the heart of the tropical jungles for consolation on their hard journeys; and missionaries, many times at the cost of their lives, have borne its message to pagan lands.

The Book That Is Really a Library

But the Bible is more than our great sacred book; it is also our greatest literary heritage. There is no other book worded with more haunting beauty than our English Bible. Merely as literature, it has made a deeper impression upon the human mind than has any other book, and the extent to which it has helped shape the world's ideas cannot be estimated. No matter how much you may know of poetry and prose, you cannot consider yourself well read unless you are thoroughly acquainted with the Bible. It is a library rather than a book, for it is a collection of books, each distinct in itself, abounding in literature of the highest type. Almost every phase of life and thought is dealt with, and every form of literature is included in its pages—stories, biographies, letters, orations, prayers, hymns of praise and thanksgiving, fierce war songs, tender love lyrics, fables, proverbs, epigrams,

genealogies, and chronologies. The vigor and dramatic force, the beauty and grandeur, of some of these books have not been excelled in any other writing.

The Bible has two great divisions, the Old and the New Testament. Testament means "covenant" or mutual understanding—a covenant between God and His people.

The Old Testament and the New

The Old Testament is the record of the history and religious literature of a little band of people, the Jews who believed in one God who was loving and just. All about the little country of Palestine were great and powerful nations, who worshiped many gods, but Israel held fast to its monotheistic belief. In the New Testament is the story of the life of Jesus and his teachings, and the acts and epistles of the Apostles. All through the Old Testament are promises that God would give His people a deliverer; and these promises, which Christianity teaches were fulfilled in the life and death of Jesus, give the thread of unity binding the Old Testament to the New.

One of the most wonderful things about this wonderful book is the way it has been preserved through the ages, and the way its narratives are supplemented by the records of the mighty empires which surrounded the little country of Palestine—Babylonia, Assyria, the Persians, the Hittites, and the Egyptians.

The Old Testament was written in Hebrew (except for a few passages in the related Aramaic dialect), and the New Testament in a popular form of Greek and in Aramaic. Into every country where Christianity spread, the Bible was translated into the language of that country—first into various Eastern dialects, then into Latin, the language of the Romans, and then into the languages of Western Europe. No

other book has been translated into so many languages. The whole of it has been translated into about 200 languages and parts of it into more than 850. The greatest of the early translations was that into Latin made by St Jerome who lived about 400 years after Christ. This translation known as the Vulgate is today the official Bible of the Roman Catholic church throughout the world. It was also the basis of the earlier translations into English and other European tongues and of the Douay (Douai) English translation which is used by English speaking Roman Catholics. It is an interesting commentary on the interest taken in the Bible that when printing was invented in the 15th century the Latin Bible was the first complete book printed.

Parts of the Bible were early translated

into English. The first writer to do this was believed to be Caedmon though it is true he did not translate the Bible at all in the usual sense but sang its divine stories so that the uneducated people of his time could understand them (see Caedmon). Other translators including the Venerable Bede gave to the people of England fragments of the scriptures in their own tongue. It was not until the year 1382 however that the whole Bible was translated into the English language.

Famous Translations of the Bible

This first English Bible translated from the Latin Vulgate (1382) and copied out by hand is considered by many to be the work of the group of early reformers led by John Wycliffe and bears his name. Great opposition to it arose because its authors were heretics and translated many passages in a sense not approved by the church. Nevertheless it was so widely circulated that in spite of the fact that its reading was prohibited by law there are more than 100 manuscript copies of it preserved today.

William Tyndale who was born a hundred years after Wycliffe's death went back to the original Hebrew and Greek versions and his translation of

many passages is so good that much of it is preserved in the English Bible of today. Tyndale too was a heretic and when the first of his books reached

A HEBREW SCHOLAR READING FROM A SCROLL



Seated with a scroll before him, this venerable old man with the white beard is studying in the original Hebrew the faith of his fathers as recorded in the Old Testament. The scroll is unrolled with one hand as he follows it page by page and reads up with the other.

England from the Continent they were burned as pernicious merchandise. The new art of printing however spread his Bible far and wide. In the end Tyndale was condemned as a heretic on the Continent and he became one of the martyrs for the Protestant faith.

Miles Coverdale's Bible (authorized in 1535) was founded in part on Tyndale's translation while the 'Great Bible' ordered by Henry VIII in 1539 to be placed in all the churches, was partly based on Coverdale's version and partly on the work of John Rogers later a martyr.

When James I came to the throne the Reformation had been established in Great Britain and the church services

were all in English. He desired an English Bible more perfect than any then existing and so he instructed 47 biblical scholars to prepare a new translation. The result of their labors was the King James Version published in 1611. For over 300 years this has been the authorized version of the Protestant English-speaking people. With its simple majestic Anglo-Saxon tongue it has been called the greatest book in the English language. Late in the 19th century in 1881 a revised version was published in England. In 1901 the American Standard Version was published in the United States. Scholars have now revised this version to clarify some of the archaic wording and published a new phrasing of the New Testament in 1946 and the Old Testament in 1957.

For English-speaking Roman Catholics the Bible most frequently used is the Douay Version. This was first produced at the University of Douai in France by Catholic refugees from the England of Elizabeth I. Dr Gregory Martin formerly of Oxford played the chief part in the translation which was revised by William Allen and others. The New Testament was published in 1582 and the whole Bible in two volumes in 1609 and 1610.

The Revised Version, made desirable by the discovery of new manuscripts, was published in 1885 by a committee of English scholars cooperating with a similar committee appointed in the United States. Its translations are more accurate, but it lacks the beauty of language of the King James (or Authorized) Version.

In the early Christian Churches—at Ephesus, Jerusalem, or Rome—say 50 years after the death of Jesus, church services were secret. The Christian worship was forbidden by the law of the Roman Empire. After preliminary prayers and singing, amid a rustle of anticipation, the leader would turn to a great chest hung with silken curtains. Many scrolls of writings were in this chest, among them the sacred writings of the Jews, copies of letters from Fathers of the new church, and writings of Christ's own Apostles. If we could understand the ancient language, the passages read would all sound very familiar to us, for we have heard them over and over again in our churches and Sunday schools. These scrolls or *biblia*, which is the Greek word for "books," have all disappeared. But before they were lost or destroyed, copies and translations were made of them, and from these was put together our Bible of today.

Establishing the Canon

The Old Testament as we know it is by no means the whole of ancient Jewish religious writings. Only gradually did learned rabbis and scholars establish the *canon* of the Hebrew scriptures. (The word "canon" in Greek meant "rule" or "measure." Applied to the Scriptures, it refers to the list of books that are accepted as inspired.) In early Christian times, as at present, the official Jewish canon comprised 39 books. But in certain parts of the world, particularly among the Greek-speaking Jews of Alexandria, more than this number of books were used.

When St. Jerome made his great Latin Vulgate translation of the Scriptures, he depended mainly on the Hebrew text for the Old Testament. He included in his canon only the 39 books he found in these manuscripts. But in the Septuagint (a famous Greek translation of the Hebrew scriptures) he found 13 documents not included in the original Hebrew. These he put in a separate section of his translation. He desig-

nated them *Apocrypha* (from the Greek for "hidden," or "hidden books"), warning that they did not have equal authority with the canon. During the Middle Ages a 14th document, the Prayer of Manasses, based on II Chron. xxxiii, 18-19, crept into the Apocrypha.

READING THE "GREAT BIBLE" IN ST. PAUL'S CATHEDRAL



This scene takes us back to 1539, when the new English translation of the Bible made by Miles Coverdale at the direction of Archbishop Cranmer and Lord Thomas Cromwell, and issued under the authority of King Henry VIII, was ordered placed in all the churches of England. The picture shows the eagerness with which the people flocked to the churches in order to read the Bible in the English language.

The so-called "14 books" of the Apocrypha really consist of nine complete books and five additions to certain of the canonical books. The complete books are Tobit, Judith, the Wisdom of Solomon, Ecclesiasticus (the Wisdom of Jesus, Son of Sirach), Baruch, I and II Maccabees, and I and II Esdras (also called III and IV Esdras, the canonical Nehemiah and Ezra being considered I and II Esdras). There is also a passage inserted in the book of Esther and three

insertions in the book of Daniel (the Song of the Three Children, the story of Susanna, and the stories of Bel and the Dragon). The Prayer of Manasses was originally attached to the end of the Psalms, but later to II Chronicles.

Protestants do not accept the Apocrypha as inspired, though many read them for their beauty and for the moral lessons in them. The Apocrypha were printed along with the canon in the English King James translation, but in a separate section. Since 1827 they have generally been printed only in a separate volume. Roman Catholics accept 11 of the "books" as inspired, for the Council of Trent in 1546 ruled that they were a part of the canon. The Council rejected only the apocryphal books of Esdras and the Prayer of Manasses.

The Catholic Old Testament thus includes 46 books, and the Protestant version 39. (In Catholic versions, the books of Jeremiah and Lamentations are sometimes joined and this makes the count 45.) In both versions, the New Testament comprises 27 books.

Similarly there was for a long time a difference of opinion as to what books should be included in the New Testament. There are no less than 109 of the New Testament apocryphal books, whose very names are unfamiliar to most Christians today; examples are the Epistle of Barnabas, the Teaching of the Twelve Apostles, and the Shepherd of Hermas. The canon of the New Testament was not decided until A.D. 382 at a council of the church held at Rome.

The oldest manuscripts of the collected books of the Bible go back to about A.D. 350. The oldest known is the Vatican manuscript kept in the Vatican Library at Rome which contains almost all the New Testament in Greek. The Sinaitic manuscript of about the same date contains all the New Testament and part of the Old. This was found in 1844 in a monastery at Mount Sinai. It is now in the British Museum which paid about \$500,000 for it in 1934. The British Museum also has the Alexandrine manuscript which contains most of the Old and New Testaments. The oldest known fragment of the Bible is one of the Dead Sea Scrolls, the Book of Isaiah found in 1947 in a jar in a cave above the Dead Sea. It probably dates from between 167 and 37 B.C. In another cave nearby Arab shepherds in 1953 found 70 Biblical scrolls believed to be 2,000 years or more old. Thirty-nine of these scrolls are manuscripts of 19 books of the Old Testament.

Some of the Bible manuscripts are palm-leaf manuscripts called because the original writing on the parchment sheets had been erased so that they could be used for other writing. Scholars use chemicals and photography to make the original content legible.

The New Testament was written in Greek. There are nearly 2,000 ancient manuscripts of the whole or parts of the New Testament written in Greek, but none is older than the manuscripts described above. In recent years in excavations in Egypt there have been found several pages containing sayings of Jesus which are probably a century or more older than the oldest New Testament manuscripts we have. These fragments contain teachings of the Master which are not recorded in the New Testament as it later took shape.

The work of comparing such early manuscripts and correcting the text and revising the translation has gone on from early days. When the Temple at Jerusalem was burned in A.D. 70 much of the sacred literature of the Jews was lost, but a school

of rabbis was formed at Tiberias to restore it. Alexandria in Egypt early became a center for the study of the Christian writings. All through the Middle Ages patient monks were busy copying and so preserving the sacred texts. And with the publication of the printed Greek text of the New Testament by Erasmus in 1516 and by the Spanish cardinal Ximenes in 1522 the modern study of the Bible began.

Some Notable Bibles

One of the most beautiful of the Bible manuscripts in existence is a translation into the Gothic by Ulfilas, the missionary to the Goths, which is now preserved in Upsala, Sweden. The manuscript has silver letters on purple vellum.

The 42-line Bible on which Johann Gutenberg with the support of Johann Fust worked from 1450 to 1455 was the first important book printed from movable type. It is sometimes called the Mainz Bible because the first copy described by bibliographers was found in the library of Cardinal Mainz in Paris. There are 38 known perfect copies printed on paper and only three perfect specimens printed on vellum. One of the latter, for which a famous collector paid more than \$350,000, is now in the Library of Congress. The Bibliothèque Nationale has another and the British Museum the third.

The Complutensian Polyglot published by Cardinal Ximenes in 1522 prints the Greek of the New Testament in one column and the Latin of the Vulgate in the other. For the Old Testament it gives the Hebrew on one side, an old Greek translation (called the Septuagint) on the other, and the Latin Vulgate between.

The Bug Bible (1551) was so called because of the translation of Psalm xcix 5, "afraid of bugs by night" instead of our "terror by night."

The Breches Bible is an English version published at Geneva in 1550 and is named from its translation of Genesis 7: "This reads, making themselves breeches out of fig leaves."

The Wicked Bible printed in England in 1631 left out the word "not" in the Seventh Commandment. For this error the unfortunate printer was fined the equivalent of \$1,500 in present-day money.

The Thumb Bible was published in 1670 at Aberdeen, Scotland. It was so called because it measured only one inch square and one-half inch thick.

The Vinegar Bible (1717) has as the heading of the 20th chapter of Luke, "The Parable of the Vineyard" instead of the vineyard.

The Devil's Bible is the name given a manuscript of the Bible taken to Stockholm after the Thirty Years War. It is beautifully written on 300

asses' skins. According to legend the manuscript is the work of a monk condemned to death who by selling himself to Satan was enabled to save his life by meeting the condition that he should copy the whole Bible on asses' skins in a single night.

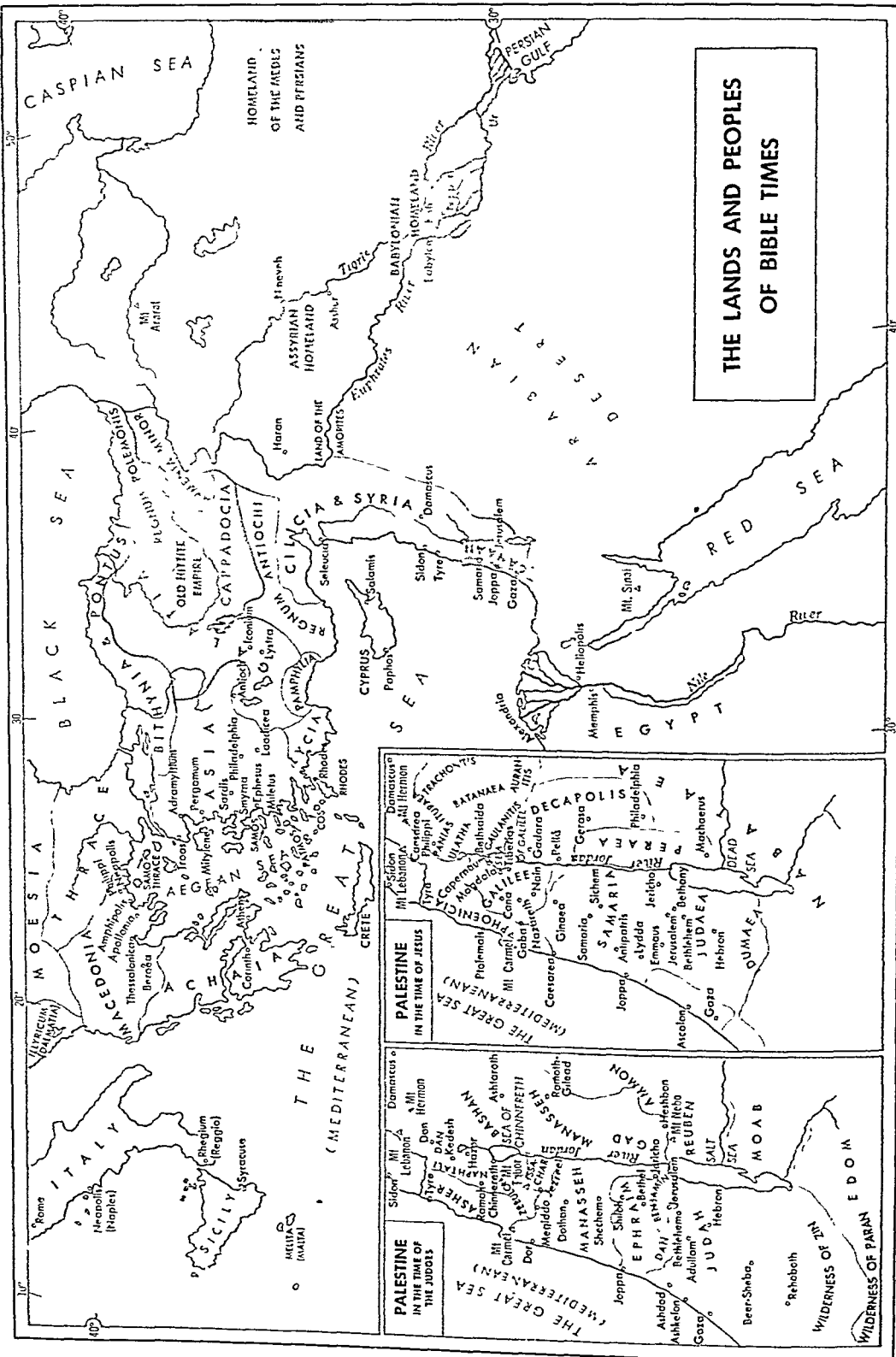
The Caxton Memorial Bible was wholly printed and bound in 12 hours in 1877 to celebrate the 400th anniversary of the introduction of printing into England.

One of the smallest bibles in the world was printed in Glasgow in 1901. Without the cover it is seven sixteenths of an inch thick. It has 876 pages and several illustrations. A magnifying glass slips into a pocket in the cover.

INFINITE RICHES IN A LITTLE ROOM



This tiny Bible, published in 1901, is one of the smallest books ever printed. The pages measure $1\frac{1}{4}$ by $1\frac{1}{2}$ inches but can be read easily with the magnifying glass.



Palestine was the scene of most of the events related in the Bible. Here the Israelites lived. At various times, their neighbors held away over part or all the area. (The homelands of some of these conquerors are shown in red.) These peoples were, in turn, conquered. During early Christian times Palestine was a part of the Roman Empire.

BIBLE LANDS Every important land mentioned in the Bible lies within 1,500 miles of Jerusalem. To the east is the great, fertile valley of the Tigris and Euphrates rivers, the homeland of ancient Babylonians. Here, on the bank of the lower Euphrates, was the city of Ur which the Bible names as the birthplace of Abraham, the first man to be known as a "Hebrew" (See Abraham). Beyond Babylon is the region where the Assyrians, the Medes, and the Persians lived.

To the southeast of Jerusalem is the vast dry Arabian Peninsula, while to the southwest is the much smaller Sinai Peninsula. West of Sinai lies Egypt with its rich Nile Valley. It was in Egypt that Joseph rose to power in the Pharaoh's court, and it was there that Moses took the leadership of the Israelites to bring them out of bondage.

Far to the north, in the peninsula of Asia Minor, was the old Hittite Empire. In New Testament times this area was divided into various provinces of the far-flung Roman Empire. Paul, the first great Christian missionary, traveled through the southern and western parts of the peninsula and crossed the Aegean Sea to Macedonia and Achaia (Greece). The last journey of this energetic apostle carried him as far west as Rome, the capital of the vast empire.

Although the Biblical world extended across this relatively large territory, the majority of events related in the Bible occurred in Palestine, an area about the size of the state of Vermont. Palestine is a part of the great Fertile Crescent, a semicircular area stretching from the Persian Gulf to Asia Minor and southward along the Mediterranean coast. Mountains border the crescent on the north while the Arabian Desert flanks it on the south and southeast. Thus the crescent forms a natural route for caravans and warring armies passing between Mesopotamia and the west. Abraham followed this route when he moved from Ur to Haran and thence to Canaan, as Palestine was then called. After the Israelites made their exodus from Egypt under the leadership of Moses, they conquered the native people of Canaan and made their homes in the region. They divided the land among all the tribes of Israel, with the exception of the tribe of Levi. This tribe was devoted to the priesthood.

One of the most interesting features of the geography of Palestine is the valley of the Jordan River. The Jordan rises in Lebanon and flows southward for a distance of some 200 miles. In its course it flows through tiny Lake Merom (Huleh) and the Sea of Galilee and empties into the Dead Sea (see Palestine).

How Scholars CLASSIFY BOOKS to Meet ALL NEEDS

BIBLIOGRAPHY. There are said to exist in printed form about eight and a half million separate writings, each long enough to be called a book. No one can, of course, read more than a few thousand of them in the course of his lifetime. It is therefore important that he select for his reading the books which will best serve his particular needs. Bibliography is an apparatus designed to assist him in making his selection. These eight and a half million books record the most important things which men have done and felt and thought. Any person can turn to this printed record and draw upon the stores of knowledge accumulated by past generations in much the same way that he can recall his own past experiences. In one sense our books, taken as a whole, form the memory of the whole human race. Bibliography is the key to this memory. It is a switchboard that connects the person who wants a particular kind of book with the available books of that character.

Our word "bibliography" comes from two Greek terms meaning 'book' and 'writing'. Thus in the broadest sense any literary composition about books might be called a bibliography. In ordinary use, however, the word has a narrower meaning, usually it is applied only to instructive lists of books.

Not every list of books is a bibliography. A bookseller's inventory of his stock is a catalog but not a bibliography, because it is primarily concerned with neither the authorship nor the textual content of the volumes which it enumerates. A bibliography must include the element of intellectual purpose. In short, it must be adapted for use as a working tool.

Whether it is called a bibliography or a handbook or a guide or an encyclopedia, every book is a bibliography if it contains a systematic list of books which may serve for a particular purpose. Necessarily there are all sorts of bibliographies to meet all sorts of different needs. There are author bibliographies, as for example, a list of all the writings of Charles Dickens, subject bibliographies, such as lists of useful books about chemistry, bibliographies of literary form like lists of one-act plays, local bibliographies such as a list of the works of the New England poets, period bibliographies, like lists of the literary productions of the Age of Elizabeth, language bibliographies, as a list of books written in Spanish. There are even bibliographies of bibliographies.

The value of any bibliography depends upon four different elements: the knowledge of the person who compiles it, the extent to which he imparts that knowledge, the ease with which his book can be used, and its accuracy in detail.

The best bibliography on any subject is one written by a specialist in that field. Usually a select bibliography of the best books, when compiled by such a person, is more useful than one listing all the available literature of the field.

For the convenience of the reader, a good bibliography distributes its subjects under logical subdivisions. A reader seeking books about Shakespeare will find little help in a single list of all the books about all the English dramatists. Indeed if what he wants is only definite information about Shakespeare's education, a complete list of all the books about

Shakespeare, arranged in one alphabet according to their author's names, will be equally useless. A bibliography should divide and subdivide its subjects until only a few books are included under each topic, and arrange these topics so logically that a reader can turn quickly to the particular section he wants.

The Importance of Accuracy

The bibliographer must also be accurate. When he mentions a book he must do it in such a way that his reader can be certain of just what book he means. For this purpose he will do well to use the conventional system which has proved well suited for the purpose. This system records certain facts about each book which may be regarded as the indispensable elements of detailed bibliographical description. In their simplest form these are: author, title, place of publication, date of publication, and size of the book. All except the last of these elements appear on the title page of every ordinary book. Although they are simple facts, a beginner sometimes has trouble with the first, second, and fifth. In the citation, each author must be distinguished definitely from all other persons bearing the same name. Family names alone are therefore insufficient. To refer to a particular person his full name (or at least his initials) must always be given. Where even this is not completely distinctive, it is customary to add the birth and death year of each individual. The same general principle will govern the form used for recording the title of a book; enough must be given to prevent any possible confusion. Where the title is unusually long, non-significant words may be omitted, and the omission indicated by the conventional *hiatus* sign (three dots) on the line of the writing. In the record of size conventional usage varies. Usually approximate indications are sufficient. It makes little difference to the ordinary reader whether a book contains 272 or 288 pages. It makes a great difference whether it is a slender pamphlet or an extensive treatise in many volumes. Similarly most readers will want to know whether a book is a portable volume or the size of an atlas.

On the other hand, every reader and collector will desire assurance that the book he is using is not incomplete. If his volume lacks an important preface, illustrative plates and maps, or index, he will prefer to discard it for a complete copy. If he is in doubt he may consult the *collation*, or exact list of parts which this book ought to contain. To record all these facts, various devices are used. Each bibliographer will select the one best adapted to his purpose. The following typical examples will bring out the differences between meager and elaborate forms of bibliographical record. The principal difference, it will be noted, lies in the details of collation.

Defoe, Daniel.

... Robinson Crusoe . . . N. Y. 1923. 362pp. 8°.

Defoe, Daniel.

The life and surprising adventures of Robinson Crusoe of York, mariner. New York, Harper, 1923. 5p. l., 362, [1]p. incl. illus., plates, col. front., map. 23½ cm.

These two descriptions of the same book illustrate the difference between simple and complete records. The abbreviations in the collation read: five preliminary leaves; 362 numbered pages, plus one unnumbered page, including illustrations and plates; colored frontispiece, and a map. The volume is 23½ cm. (9¼ inches) high.

For a book written by a single author these five elements are usually sufficient, but many books are of such a character as to introduce complications which must be provided for in the scheme of bibliographical description. Some books are enlarged or revised by their authors in successive editions. Whenever this is done the bibliographer must distinguish the text that he cites. Other books are written by two or more authors working together. Still other books are reissued after the death of their authors and various changes made by their editors: obsolete spellings may be corrected, modern punctuation introduced, footnotes added, certain passages omitted, and new ones introduced. Other books may be illustrated so beautifully that the pictures are more important than the text. The bibliographer must always add to his record the names of all persons who contributed in a constructive way to the production of the book in the form in which he has it. Usually he will also make a separate citation under the name of each of these secondary contributors. Citations of this kind are technically known as added entries.

There are also many books which are compiled or issued, not by individuals but by organized bodies. Such books the bibliographer describes as of corporate authorship. These are of various sorts, but most of them are official publications of governmental bodies, laws, debates, decisions, and reports of federal or local legislatures, courts, departments, commissions, and bureaus. National academies and other learned societies also contribute a large mass of corporate literature through the publication of their transactions, contributions, and reports. Even where the writer of a particular publication of this kind is known, it is customary to cite the body that authorized it as the corporate author, with a cross-reference from the name of the person who actually did the writing.

Serials and Periodicals

Still another variation from the simple formula is necessary in a reference to a writing which has appeared as a part in a serial publication. Some serials are published irregularly as the parts are completed. These are variously entitled "Collections," "Libraries," and the like, by their publishers. Successive parts usually bear only the year of their publication. This form of date will ordinarily distinguish "serials" from "periodicals"; these latter appear at regular intervals and are dated with the month or day of their appearance. Today much of our most important current literature appears in the form of periodical publication. The following examples illustrate the description, first, of material published in periodical form, and second, of a serial item:

Need, Elizabeth Connell.

Of Reading with My Children. In Horn Book Magaz. oe
XXVII 13-18 Jan.-Feb. 1951
United States Office of Education
Bulletin 10 Smith Paul E Teachers Abroad Ex-
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ton, 1950

The General Reader and Bibliographies

Because the interests of individual readers are so varied and bibliographies are so numerous it is impossible to compile a generally useful brief list. A useful bibliographical tool for a home library is 'The Bookman's Manual: A Guide to Literature' compiled by Bessie Graham and published by the R. R. Bowker Company. A new edition of this manual is published every few years.

Most large public and college libraries have extensive collections of bibliographies. To aid the student in finding them, cards are filed in a card catalog. These indicate the bibliographical material available on any subject. Larger libraries also provide such tools as the 'Bibliographic Index', which is published quarterly and in cumulative annual volumes.

Even the smaller libraries provide some standard bibliographical tools which are available to the general public. Among these is the Standard Catalog Series, published by the H. W. Wilson Company. This series includes the 'Standard Catalog for Public Libraries', 'Fiction Catalog', 'Children's Catalog', and 'Standard Catalog for High School Libraries'. Similar but shorter lists, published by the American Library Association, include 'A Basic Book Collection for Elementary Grades', 'A Basic Book Collection for Junior High Schools', 'A Basic Book Collection for High Schools', and the 'Buying List of Books for Small Libraries'.

Librarians and Bibliographies

Every librarian by the very nature of his profession must be something of a bibliographer. All major libraries and many small ones prepare reading lists regularly on popular subjects which are simplified bibliographies. In response to individual readers' needs short reading lists are frequently prepared to aid in personal book selection. For this work larger libraries designate special staff members as "readers' advisers" to aid in planning reading programs for individuals, study groups and clubs.

Every professional organization of librarians devotes some attention to bibliographical problems. Many librarians are also members of the Bibliographical Society of America. This society serves as a clearinghouse for bibliographical enterprises, co-ordinates the work of its members, and publishes contributions to the advance of the science.

Book lists covering major subjects accompany the Reference Outlines in this encyclopedia. Shorter lists have been added to many other articles. All these are examples of good, simple bibliographies. The librarians who compiled them selected the best current books and identified them briefly and accurately, giving just the necessary information to help find the book in a library or bookstore.

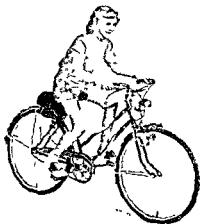
BICYCLES AND MOTORCYCLES Riding a bicycle, or cycling as it is called, is more popular today than ever before. In the United States alone about 20 million people ride bicycles for recreation and transportation. In Europe, Japan and elsewhere bicycles are more widely used than automobiles.

The title "father of the bicycle" is usually given to a German, Karl Drais, who invented a two-wheel velocipede in 1816. The rider of this machine rested his weight upon the frame and moved by kicking the ground with his feet. The first major advance came in 1865 when the rotary crank-driven velocipede was invented in France. About 1869 iron tires were replaced by steel rimmed wheels with solid rubber tires. These machines—now called bicycles—were first produced in England.

"BIKES" BUILT FOR SPEED AND COMFORT

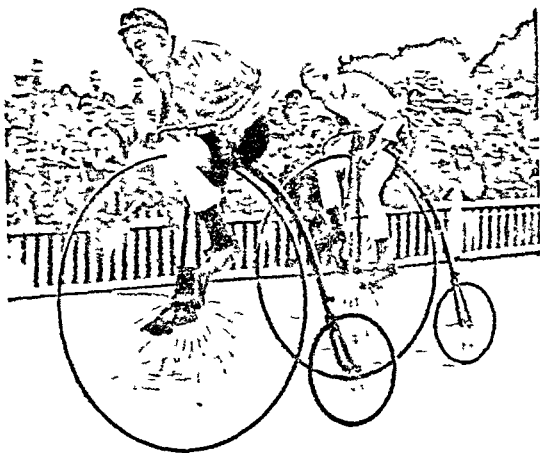


This streamlined boys' "bike" is specially equipped with a shock absorber on the front wheel and with white side-wall tires.

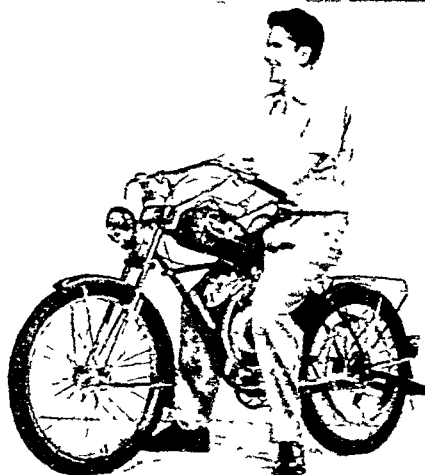


Special equipment on this girls' "bike" includes a gear shift for three speeds and a hand brake (both on right handle bar).

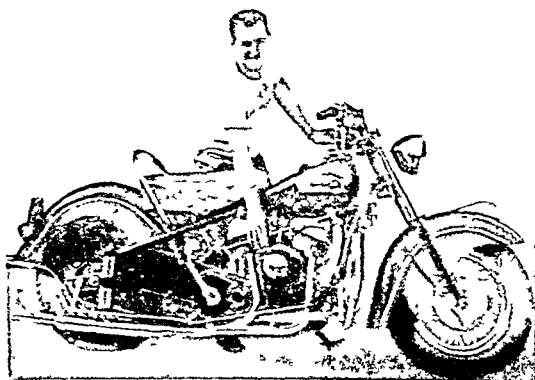
"ORDINARIES" AND THEIR MODERN OFFSPRING



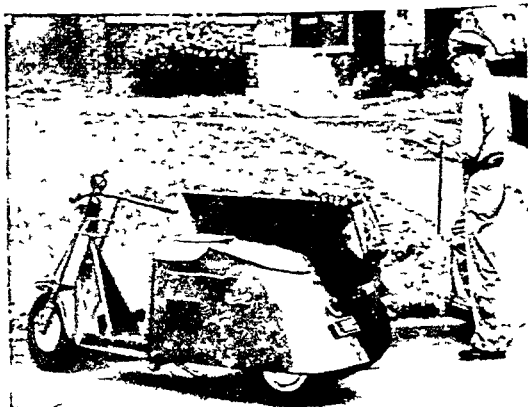
These high-wheeled "ordinaries" were widely used during the 1870's both for sport, as shown here, and for business.



Adding gasoline-engine power to human-foot power, this sleek motor "bike" is designed for speedy, economical transportation.



On the modern motorcycle many important controls—throttle, front-wheel brake, clutch—may be located on the handle bars.



This mailman uses a motor scooter with a sidecar capable of carrying a full load at a speed up to 35 miles an hour.

In the early bicycles (commonly called "ordinaries") the pedals operated directly on the front wheel, which was 60 to 64 inches high. The small back wheel was used to steer. About 1880 the "star" bicycle was invented. In this model, the pedals operated on a large rear wheel with a small front wheel for steering. Both types, however, were so high they were difficult to mount and ride.

Invention of the "Safety" Bicycle

During the 1880's the low, "safety" bicycle with two wheels of equal size took the place of the old high machine. This was made possible by using a sprocket-and-chain device to drive the rear wheel. Soon after this came the invention that made the bicycle really popular—the easy-riding pneumatic tire. Ball bearings and the spring saddle were later improvements.

The coaster brake and "free wheeling" increased the safety and comfort of cyclists. The free-wheeling device operates by temporarily disengaging the rear wheel from the sprocket and chain by means of an

overrunning clutch, thus permitting the wheel to turn independently while the pedals remain at rest. A slight backward motion of the pedals applies the brake. Some types of bicycles have a hand brake, but safe riding on any "bike" depends ultimately on the rider. (For the rules of safety that all cyclists should follow, see *Safety*.)

In the United States, bicycle riding reached its first peak of popularity during the late 1890's. When the automobile came into use, this popularity declined, though the bicycle continued to be used for delivery work as well as for recreation and sport. During the 1930's young people again took to riding "bikes." The automobile tire shortage during the second World War also helped renew the demand for bicycles. This increased usage continued after the war, helped in part by the manufacture of new models of lighter weight and greater speed.

For Safe, Smooth Riding

To get the greatest enjoyment out of cycling the bicycle must be kept in good running order. The fol-

lowing points will serve as a guide to proper maintenance of a bicycle

1 Make the correct saddle height adjustment. A rider should be able to touch the ground with the tip of his toes when comfortably seated

2 Adjust handle bars to most comfortable position

3 Keep tires inflated to correct air pressure at all times

4 Stones embedded in tires should be removed at first opportunity

5 Chain and all movable parts should be kept clean and oiled

6 Bell should ring loud and clear

7 Front light should be visible for 500 feet rear light or reflector for 300 feet

8 Give bike thorough checkup every 200 miles of riding

9 When "bike" will not be used for several days stand it upside down

10 Major repairs should be made by a good serviceman the average rider should do only minor repairs

Bicycles with Motors

The motorcycle is a bicycle propelled by a gasoline engine. The first machines which were introduced about 1891 were equipped with one-cylinder motors. Now they have two or four cylinders. These may be two or four-cylinder engines. The one-cylinder engine has a high power output for its size but riders have trouble silencing the noise of the exhaust without losing a large amount of power. This engine is also somewhat hard to start and does easily in traffic. The multicylinder engine is usually far more satisfactory. Racing motorcycles have attained speeds of more than 150 miles an hour.

Motorcycles are used for police work and for commercial deliveries as well as for sport. They sometimes have a sidecar for an extra passenger or for goods. One German model sends power to the sidecar wheel for extra traction. Motor scooters have small gasoline engines for power. They were developed from the familiar scooter or gnomonally propelled by one foot. Motor bikes are ordinary bicycles fitted with one-cylinder engines. Both motor scooters and motor bikes are used for business as well as for recreation.

Motor-driven bicycles can be as safe as regular bicycles if the cyclist observes traffic regulations and keeps a careful watch on automobiles and pedestrians. It is especially important to obey speed limits on roads and streets.

Both motorcycles and bicycles have been used by the armed forces of various countries for messengers, motorized infantry and paratroops. During the second World War German and Japanese armies used bicycles extensively as a means of conserving gasoline.

BIENVILLE JEAN BAPTISTE LE MOYNE SIEUR DE (1680-1768) For nearly half a century Jean Bienville a French Canadian labored to develop the French colony founded by his brother Iberville at the mouth of the Mississippi River (see Iberville). As governor of the colony Bienville had to contend with disease, hostile Indians and enemies among his

own countrymen. Only his vigorous leadership enabled the colony to survive. He climaxed his work for France by founding New Orleans.

Bienville was born in Montreal Canada Feb 23 1680. He was one of 11 sons of Charles le Moyne a French nobleman and Canadian pioneer. The title Sieur de Bienville was bestowed upon him in 1691. At the age of 12 he joined the French navy and went to serve in a ship commanded by his older brother Pierre Sieur d'Iberville. During a battle with the English on Hudson Bay in 1697 Bienville was wounded. A year later when Iberville sailed from France on an expedition to rediscover the mouth of the Mississippi River and to plant a colony in the Louisiana country Bienville accompanied him.

Early in 1699 the expedition reached the mouth of the Mississippi. The first settlement was soon established by Iberville near the present site of Baton Rouge. Bienville spent two years exploring the surrounding country and learning the ways of the Indians. He became governor in 1701 and the next year built Fort Louis de la Mobile on the Mobile River.

The future of the colony seemed bright but in 1704 the dread yellow fever struck down many of the settlers. After this disaster Bienville's enemies succeeded in having him removed from the governorship. A new governor Antoine Cadillac arrived in 1713 (see Cadillac). Bienville then second in command wanted to marry Cadillac's daughter but enmity between the two officials prevented it. Bienville never married. In 1716 he defeated the Natchez Indians and built Fort Rosalie on the site of present Natchez, Miss. He was restored to the governorship in 1717 and a year later founded New Orleans. His last years as governor were harried by Indian wars. Weary and discouraged he retired in 1743 and spent the rest of his life in Paris. There he lived to see the colony he had built pass into the hands of Spain.

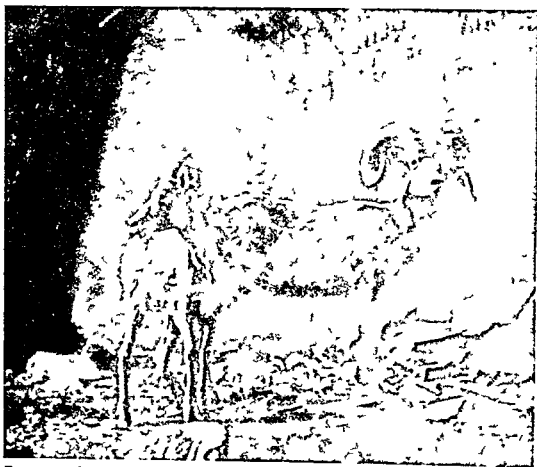
BIGHORN In the early days the wild sheep called the bighorn or Pocky Mountain sheep ranged throughout the whole western mountain system of North America from Alaska to New Mexico. They are becoming rare but may still be found in the rocky plateaus of the Bad Lands of Dakota and in greater numbers about the headwaters of the Yellowstone River and thence northward.

The massive circling horns of the male which give the animal its name are coveted as trophies and much skill and patience on the part of the hunter are needed to capture this wonderfully swift agile and tireless animal. Its flesh is generally considered to be the best of all western game. In most states the bighorn is now protected by game laws. The color is tawny yellow in summer changing to grayish brown



Sieur de Bienville

BIGHORNS AT HOME



Lean and shaggy after a hard winter a stately bighorn ram and his mate stand alertly on a crag high in the mountains.

in winter. It is about 40 inches high and may weigh 300 pounds. The horns often measure 42 inches along the curve. (For illustration in color, see North America.)

The bighorn must not be confused with the Rocky Mountain goat, or white goat, which is an entirely different animal. The scientific name of the bighorn is *Ovis canadensis*.

BILLIARDS. No other game in the world requires such delicacy of touch, steadiness of hand, accuracy of eye, and iron self-control as the ancient game of billiards. Long practice enables the skillful player to control the motions of the balls with an accuracy that seems almost miraculous to the beginner. In fact, the really expert player can do feats so far out of the ordinary man's reach that the English philosopher Herbert Spencer once remarked that to play billiards too well was the mark of an ill-spent youth. Spencer enjoyed the game thoroughly, however, and was accustomed to relax his mind after a morning of hard work by an hour of billiards at his club.

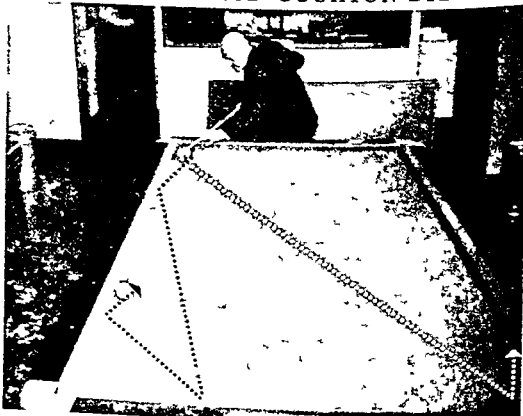
The game has been played in many different ways at various times, and even today there are marked differences between the English, French, and American games. In America billiards is played on a table usually ten feet long and half as wide, having a very smooth and level surface of slate covered with green baize. Around the edge of the table is a beveled rail cushioned with rubber from which the balls rebound lightly and easily. Three ivory balls $2\frac{3}{8}$ inches in diameter are used, one of which is red and the other two white. One of the white balls is distinguished by a tiny black spot. Each player chooses one of these white balls as his "cue" ball. This cue ball is driven by a cue, a leather-tipped wooden rod a little less than five feet long and varying in diameter from half an inch or less at the point to an inch or an inch and a half at the butt. Chalk is rubbed on the leather tip every few turns to make greater friction between cue and ball, thereby getting better control.

With the fingers of one hand the player holds the butt of his cue firmly but lightly; he places the other hand on the table so that the forefinger and thumb support and guide the forward part of the cue. The cue ball is struck with the point of the cue in such a way as to cause it to touch first one and then the other of the two remaining balls, thus making a "carom," or "billiard." Each billiard counts one point in the score. By directing the point of the cue against a part of the cue ball to one side or above or below its center, it is possible to "put English" on the ball; that is, to make it twist or curve and thus make shots otherwise impossible. Fifty points constitute a game.

One very effective way to score many points without musing is to "nurse" the balls; that is, to get them in a corner or along the rail and by hitting them very lightly hold them in one place for a long time. This easy way of running up a large score is made impossible in many professional games by marking *balk lines* 14 or 18 inches in from the edges of the table. Either every second or every third shot must be hard enough to send at least one of the balls outside the marked square in which the balls are grouped when the shot begins. Any number of caroms are allowed in the square left in the center of the table. Another form of billiard is *three-cushion*, in which the cue ball must strike three cushions before completing the billiard.

Pocket billiards, or "pool," is a different game. It is played on a table that has pockets in each corner and one in the center of each of the longer sides. In "straight" pool, the most popular of the many pool games, 15 balls and a cue ball are used. The players take turns using the same cue ball, the object being to put the 15 balls in any of the pockets. The player wins who pockets the greatest number. In "rotation" pool the balls are numbered and must be played in rotation. In this game the winner is the player who has the greatest number of points.

A DIFFICULT THREE-CUSHION BILLIARD



Willie Hoppe, greatest of all billiard players, scores a point by caroming his cue ball (route shown by black dots) off the red ball and then making it strike three cushions (or sides of the table) before it hits his opponent's cue ball.

BILL OF RIGHTS The first ten amendments to the Constitution of the United States are called the Bill of Rights. The amendments were drafted in 1789 by the first Congress because it became clear that the Constitution would not be ratified without a statement of fundamental liberties. In the 18th century it was a philosophical belief that people have certain *natural rights* that do not derive from the government. The first amendment, therefore (on freedom of religion, speech, the press, and the right of assembly), begins with the strong, clear statement "Congress shall pass no law respecting . . ." (See United States Constitution.) Most of the states also have a bill of rights in their constitutions.

The English Bill of Rights was passed by Parliament at the end of 1689 as an "Act declaring the rights and liberties of the subject and settling the succession of the Crown." It affirmed the primacy of Parliament, freedom of election, the right to have arms, and the frequent holding of Parliament. It opposed "excessive bail" and "cruel and unusual punishment." Its emphasis on fundamental rights became an accepted view among English-speaking peoples everywhere. Several of the amendments in the American Bill of Rights were taken almost word for word from it. It may well have suggested also the form for the American Declaration of Independence for both consider at some length the wrongs committed by the king.

Bills of rights have been enacted in many other countries. One of the most famous is the French 'Declaration of the Rights of Man' (1789), a product of the French Revolution.

In the Charter of the United Nations 'human rights' became for the first time an international concern. The Commission on Human Rights was created to draft an international bill of rights. Additional bodies were set up to deal with particular aspects of human rights, such as freedom of information, the political status of women, and the protection of minorities. (See also United Nations.)

BIOCHEMISTRY. The most marvelous chemical laboratory is the body of a living creature. In the countless tiny cells of every plant or animal, chemical changes are constantly taking place, so wonderful and complex that they are at once the joy and the despair of the chemist. The study of the processes of life's laboratories is one of the newest and most fascinating fields into which chemistry has entered. Students of the subject in its broadest sense call this science biochemistry; others, more interested in the medical aspect, call it physiological chemistry, but the field is much the same—the chemistry of living matter.

The first step in studying the chemistry of life is a knowledge of the nature of protoplasm, the substance of which all living things are made (see Protoplasm). The chemical elements found in protoplasm are also found in inorganic matter. No element is peculiar to life, but 12 are indispensable: carbon, hydrogen, oxygen, nitrogen, phosphorus, sodium, chlorine, magnesium, iron, sulfur, potassium, and

calcium. Sometimes protoplasm contains other elements also. The one-celled plants called diatoms contain silicon (see Diatoms). Seaweeds contain iodine, which they take up from sea water. All these chemical elements combine to form the four great groups of organic compounds—proteins, carbohydrates, fats, and lipins—as well as organic substances known as enzymes, inorganic salts and water.

The Building Stones of Life

Proteins are complex compounds of carbon, hydrogen, oxygen, and nitrogen with sometimes traces of sulfur, phosphorus, magnesium, and iron. Protein molecules come in long chains, called *polymers*. They are made of many units. Casein, for example, has the approximate formula $C_{180}H_{1230}O_{24}N_{16}S_4P_4$. Some of the synthetic proteins or protein analogues, first made in the laboratory in 1947 by Dr. Robert Woodward of Harvard University, have as high as 10,000 units. Amino acids containing nitrogen in an amino (NH_2) group are building blocks of protein polymers. Combined in varied amounts and groupings with one another and with other molecules they form many different kinds of proteins. So important are these acids that they have been called the building stones of life. The fibrin found in clotted blood, the myosin of muscles, and the gelatin of bones are examples of protein. (See also Proteins.)

Carbohydrates, as the name indicates, are compounds of carbon, hydrogen, and oxygen. They comprise starches, sugars, cellulose, gums, and many other substances. Carbohydrates combine readily with oxygen and serve as the fundamental sources of energy in living things.

Fats and lipins are organic compounds greasy to the touch and capable of being dissolved in ether, alcohol, and chloroform. Fats are composed of the same chemical elements as the carbohydrates, but contain much less oxygen in proportion to the carbon. Butter, lard, and olive oil are examples of fats (see Fats and Oils). Lipins are similar to fats but contain phosphorus and nitrogen, or nitrogen only, in addition to carbon, hydrogen, and oxygen. The commonest member of this class is lecithin which occurs in all cells, and especially in nervous tissues.

Mysterious Helpers That Defy Analysis

Enzymes are organic substances of unknown chemical composition which play the part of catalysts in life processes. Catalysts are agents that cause or hasten a chemical reaction without appearing among the end products of the reaction. All cells produce enzymes, but some, the gland cells, specialize in this production and send forth enzymes to take part in external reactions, as in digestion. (See also Enzymes.)

The *inorganic salts* contained in protoplasm are chiefly sodium and calcium chloride, with other minerals similar to those found in sea water. These salts are held in crystalline solution by water, which constitutes 60 to 90 per cent of protoplasm. Ionization of the dissolved salts is responsible for the electrical activity of protoplasm (see Electrochemistry). Physically, protoplasm is a colloidal system. The watery

solution acts as the dispersion medium for the finely divided masses of proteins, carbohydrates, fats, and lipins. (See Colloids.)

Knowledge of the chemical structure of protoplasm is essential for the understanding of *metabolism*, which is the sum total of all the chemical changes taking place in the cell. Those reactions by which protoplasm is built up are grouped under the term *anabolism*. In view of the chemical nature of this living substance, it is clear that proper food for the organism must contain those same elements or compounds. In addition it must have those marvelous substances called vitamins. The sources and composition of foodstuffs make up the second chapter of biochemical study. (See Food; Vitamins.)

But complex food materials must first be chemically changed into simpler compounds and rendered soluble so that they can be absorbed by the cells. This process is *digestion*. Here again the biochemist finds a vast field of study (see Digestion). The next inquiry concerns itself with assimilation, that is, how the nutrients that have been absorbed by the cells are combined to form protoplasm.

Metabolism also includes those reactions by which the constituents of protoplasm are chemically decomposed for the transformation of energy and the production of heat. These activities, grouped under the term *katabolism*, are in the nature of oxidations, that is, reactions in which oxygen unites with compounds of the protoplasmic system. Oxidations provide heat and energy for doing work; they furnish the power for the living machine (see Oxygen).

Putting the Oxygen to Work

In vertebrate animals the oxygen is carried by *hemoglobin*, an iron compound found in the red blood cells. Combined with hemoglobin, oxygen is distributed throughout the body by the blood stream. But *oxyhemoglobin* is a very unstable combination, so free oxygen is promptly released to the body cells when the blood enters the capillaries. (See Respiration.)

Within the cells there is a pigment called *cytochrome*, which takes hold of the oxygen and controls it in the narrow confines of the cell laboratory. Oxygen, the workman, is now on the job. Cytochrome, the foreman, holds it there. But atmospheric oxygen is sluggish, it acts too slowly, it must in some manner be "activated." The cell is ready for this emergency with certain oxidizing enzymes, the *oxidases*, which hasten the union of oxygen and assimilated foods.

Oxidation Is a Form of Burning

The process of oxidation in living tissues is identical with ordinary combustion (see Fire). Carbohydrates and fats are completely oxidized in the body and are the chief sources of animal energy, some of which is converted into heat. Proteins are also oxidized to a slight extent. The living fire consumes fuel, creates heat, but also leaves behind waste products of combustion. The oxidation of carbohydrates, fats, and lipins gives rise to carbon dioxide and water. In the case of proteins the end products of combustion are carbon dioxide, water, and a variety of nitrogen-

containing compounds. These products are no longer of use to the body. They are the waste materials of metabolism, the *excretions* (see Kidneys).

Another aspect of living matter is its ability to perform movements. Animal movements are due to the shortening or contracting of muscle fibers. How is this brought about? The living threads or fibers that make up muscle contain various substances combined with phosphoric acid. The nerve stimulus that puts a muscle to work starts a series of chemical reactions in which these muscle substances first break away from and then reunite with the phosphoric acid. The reactions are rapid and accomplish contraction (shortening) and then relaxation (lengthening) of the muscle fibers. The final chemical reaction is a "burning," or oxidation, of glycogen (animal starch), a carbohydrate fuel present in muscle. Oxidation is not direct, like burning in a furnace, but is a series of chemical breakdowns. If the body does not supply enough oxygen for complete oxidation of the glycogen, lactic acid appears in the muscle. Part of the acid enters the blood as lactate; the liver takes up some of this and changes it back to glycogen. But most of the lactic acid is oxidized by tissue cells to form carbon dioxide and water. The process may call for more oxygen than normal breathing supplies. That is why we breathe more deeply than usual for some time after strenuous exercise. We are paying off what is technically known as the "oxygen debt."

Chemistry Controls Our Size and Numbers

Other interesting problems from the biochemical standpoint are growth, which is increase in size, and reproduction, which is increase in numbers. Both of these life functions are under the control of internal secretions or hormones (see Hormones). The formation of the hormones by various organs of the body is primarily a chemical process, and their use by the body also involves chemical problems.

Turning now to the study of plants, we find similar problems of great importance for the biochemist. By far the most important chemical reaction taking place on earth is *photosynthesis*. This is the process which occurs in plants, when, in the presence of sunlight and a green pigment, chlorophyll, carbon dioxide and water unite to form carbohydrates, and oxygen is evolved as a by-product. (See Leaves; Plant Life.) All life depends upon this process, for it makes a source of energy available to both plants and animals. It is the reaction by which organic foods are made out of inorganic materials.

The older theory of photosynthesis, that the action of light on carbon dioxide causes it to give up one of its oxygen atoms and that the remaining carbon monoxide combines with water to make formaldehyde (CH_2O), has been discarded. It is now believed that the oxygen set free comes from the water and that a carbohydrate is formed. In other words, light acting on carbon dioxide (CO_2) and water (H_2O) produces free oxygen (O_2) and a carbohydrate (CH_2O).

Once the plant is supplied with carbohydrates, it can proceed to the synthesis of other organic sub-

stances The manufacture of proteins, fats, acids, alkaloids, etc., is dependent upon the photosynthetic mechanism Proteins are produced by certain cells when they are supplied with carbohydrates and inorganic salts, such as nitrates to furnish nitrogen, phosphates to furnish phosphorus, sulphates to provide sulphur, and so on Fats, consisting as they do of the same elements as the carbohydrates, originate by a modification of starches and sugars

Plant Laboratories Keep Us Alive

Think of all the useful products that are built up in the biochemical laboratory of the plant! Not only foods for man and animal, but gums, camphors, resins, all the variety of oils and essences, rubber, alcohol, tannin, iodine, the drugs that cure our ills, quinine, atropin, and a wealth of other substances Photosynthesis is behind all this, and plants produce the oxygen we breathe

Let us glance for a moment at some of the methods which chemists use in attacking life problems The chemist begins by taking apart, or analyzing, materials whose transformations he wishes to understand He sorts out the various ingredients He

attempts to isolate pure principles from a complex mixture So he discovers cocaine, or insulin, or thyroxin Then he attempts to resolve such compounds into their chemical elements Not satisfied with this, he considers the groupings of atoms in the molecule—the smallest particle of the substance He tries to picture the way in which these atoms are linked together This enables him in some cases to prepare the product artificially and more cheaply

For example, cocaine, the first drug used to produce local anesthesia, has serious drawbacks It occurs in the leaves of the coca plant, and because rare, is expensive Moreover it is dangerous and habit-forming (*see* Narcotics) The discovery of the exact molecular structure of cocaine led to the artificial preparation of a similar compound called procaine (also novocaine) which is just as effective as cocaine without being dangerous or habit-forming

This, then, is the hope of the biochemist to understand the chemical structure of life substances to gain a knowledge of life's chemical processes, and then to imitate, control, or improve upon Nature's methods for the benefit of mankind

The WONDERFUL SCIENCE of LIVING THINGS

BIOLOGY. If a "man from Mars" were to come to the earth, he would be surprised at two things—at the amazing wonder, beauty, interest, and variety of living things, with the "oneness" of all earthly life, and that so many people remain blind to the fascination of the living things which surround them In the limits of this brief article, only some of the broader aspects of the science of living things can be considered

Biology, in brief, is "the science of life" There are at least two million kinds of living things in the world With all their irreconcilable contrasts—men, earth worms, jellyfishes, oak trees, ferns, seaweeds—they yet possess many features in common All life is fundamentally one And so we have the common great science of biology, which deals especially with the far-reaching fundamental characters of living things

Of course this study is so vast that it is impossible for any one man to cover or master the whole field in detail Consequently it is broken up into divisions, of which the primary ones are *botany*, the science of plant life, and *zoology*, the science of animal life, and each natural scientist further specializes in some narrower line, such as *anatomy*, physiology, embryology, genetics, or some other of a large number of such fields But there is still place for the

HOW amazing are the revelations of Biology, which teaches the "oneness" of Life—throughout all its more than 2,000,000 earthly forms—earthworms and jellyfishes, apes and man, oak trees and seaweeds! What magic there is in the stuff "protoplasm" from which all living creatures are formed, how fascinating is the study of embryology and the laws of inheritance; and how startling it is to learn that "all the people in the world at any one time have had their heredity carried by a total of less than an ounce of matter!" Here are presented the chief facts of the science of Biology, with an indication of its chief lines of advance in the past hundred years

common science of biology, to take account of living things especially in their larger relations, and to correlate all of the many divisions of the subject

The modern science of biology differs from the old-time "natural history" chiefly in that the latter was, in the main

a great accumulation of disconnected facts about plants and animals Biology, on the other hand, takes account of the detailed facts mainly as they illustrate the principles and laws that govern life At present the term natural history is customarily used to apply especially to the out-of-doors study of the habitats, habits, modes of life, seasons, and activities of living things, both plants and animals While this outside study of living things has its wonderful fascinations, the same is true also of the other phases of their study, but these take more patience, serious study, and often the use of the microscope and other facilities

Common forms of life, of course, are easily divided into the two great types—plants and animals—with clear distinguishing characters for each At the bottom of the scale of life, however, the plant and animal kingdoms converge, and there are some simple microscopic forms which are not clearly one or the other, but possess some characters of each And so it is impossible to draw a sharp line between the plant

and animal kingdoms. But starting with slightly higher forms of life, the differences between plants and animals are well established.

Most plants contain the green coloring matter called chlorophyll. This is a complex chemical substance that enables the plant to use the energy of sunlight for its own growth and development. With it the plant manufactures the thousands of other substances necessary to life out of the carbon dioxide in the air and the water and minerals it draws from the soil. No true animals contain chlorophyll. For this reason no animals can manufacture from the raw materials of the earth and the air the essential materials of life. They must get these directly or indirectly from plants. Certain plants, like the fungi, lack chlorophyll, and therefore they too must depend on green plants for their food (see Plant Life; Fungi).

Other distinguishing features are these: Plant cells have walls made of the woody material called cellulose; animal cells do not. Plants are usually stationary; most animals move about freely. Most animals have well-defined nervous systems; no such system is found in plants.

The Stuff That All Life Is Made Of

But with all their differences, plants and animals have certain fundamental characteristics in common. In all forms of life, the living substance is *protoplasm* (see Protoplasm). And while this takes many varying forms in different plants and animals as well as in different parts of the same plant or animal, all protoplasm is fundamentally alike. It contains always the following 12 chemical elements: carbon, oxygen, nitrogen, hydrogen, sulphur, calcium, magnesium, sodium, potassium, phosphorus, chlorine, and iron. It may also contain several others, including copper. All of them are common in nature everywhere. Furthermore, all forms of protoplasm—plant or animal—are subject to

physiological reactions. They are sensitive to external influences, such as touch and temperature, and the chemical behavior of this "life substance" follows well-defined patterns (see Biochemistry).

All organisms feed and grow. They all breathe, in the sense that they take in oxygen and give off carbon dioxide. They

all are made up of cells and all reproduce themselves by cell division of one kind or another (see Cell).

Conditions of Life

In viewing the life of the world, it is always fascinating to think of the conditions that are necessary to make life possible on earth—all of them necessary. One thinks first, perhaps, of the sun and its rays, bringing light and warmth, often forgetting that the sun is also the sole source of all the energy for plant growth and for the food supply for the whole living world. And so it was, through the many million years of the infinite past, while Nature was slowly and

patiently depositing the vast storehouses of energy in the form of coal, oil, and gas, for the uses of modern man—all derived from the remains of the plants and animals of the past! Vast quantities of water are also absolutely necessary. Water forms the larger part of protoplasm and is the universal solvent for the foods of both plants and animals. The water vapor of the atmosphere furnishes a blanket that helps to retain the heat from the sun. The vast reservoirs of the sea help to stabilize the temperature of the earth. An atmosphere of moderate temperature, with oxygen for respiration for all life and with carbonic acid for plant food, is absolutely necessary, as are also all of the chemical elements that enter into the formation of protoplasm. Other conditions, more difficult to explain, are also necessary for life as we know it.

Is there Life in Other Worlds?

All in all, life in our world is possible only by the combination of so many and such peculiar conditions

THE STORY OF THE TRANSMISSION OF LIFE

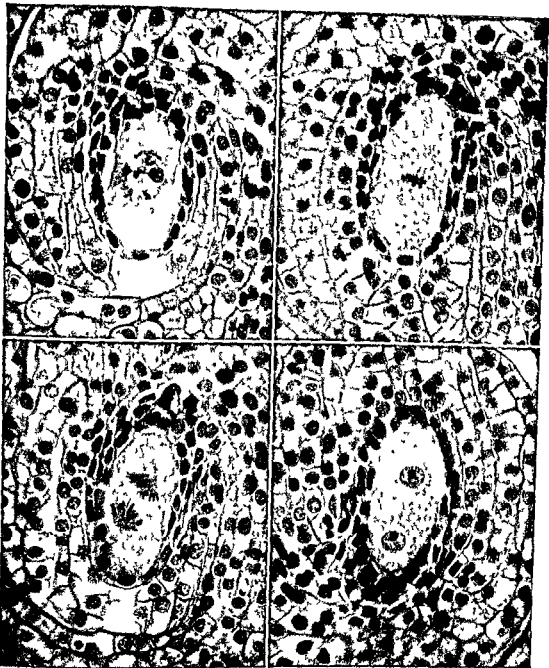
IN thinking of living things it is most important to realize that they are all made up of tiny units of protoplasm which we call "cells." These cells are of many kinds, each with a special task to perform. There are blood cells to carry oxygen from the lungs to all parts of the body, muscle cells for movement, gland cells to produce digestive juices, nerve cells to convey messages back and forth. But all of the cells that form a plant or an animal have come from a single cell at the beginning of its life. By a beautiful and mysterious process this single cell divides into two, and each of these into two—always two—and so on, until there have been formed the millions and millions of cells that make up its body.

Within the walls of each cell is a nucleus containing tiny threads of a substance called "chromatin." This chromatin is the most wonderful of all living matter, for it controls all life. The picture on the opposite page shows how the chromatin threads form tiny rods, which split in halves. It shows how these halves divide into two equal groups, and how each of these groups becomes the center of a new cell. The cells of an acorn multiply into a giant oak in just this way, and when you use up muscle cells in work or in play, new cells to take their place are produced in the same manner.

But more wonderful still is the process at the beginning of a new life which keeps the vital flame burning. Consider a flowering plant, for instance. Down in the flowers, sheltered from harm, are many tiny delicate egg cells—the mother cells. A gust of wind, or an insect roving in search of nectar, brings to one of these a pollen grain from another flower. This pollen grain is the father cell. Left alone by themselves the mother cell and the father cell would die. But now the chromatin in the tiny father cell, following a mysterious instinct which lies at the very heart of life's secret, grows down into the flower and unites with the chromatin of the mother egg cell, and fertilizes it. At that moment the new life of the plant begins. The fertilized cell divides again and again, as described above, until it forms the tiny embryo plant, which lies folded up within the seed and is ready to unfold and grow when the seed germinates.

The process is similar among animals,—a single tiny male cell penetrates and fertilizes an egg cell, and causes it to develop into a new animal. Half of the chromatin in that first fertilized cell is given by the mother and half by the father. That is why the new life resembles both parents. As the cells go on dividing, each of them has material from both of the parents.

Can you think of anything more wonderful than this strange power, locked up in a cell so small that the eye can't see it—the power to multiply and create bone and muscle, nerves and brain, the power to create new life, and to carry over to that new life those complex details of face, features, complexion, and even of mind and character which the parents possessed?



CELL DIVISION—THE BASIS OF LIFE AND GROWTH

These color photomicrographs made through a microscope show the most important stages in the division of a fertilized egg cell in the ovary of a fish. Upper left: the large oval is the egg cell; the round nucleus in the middle of the cell contains the dark stained chromosome threads and the red stained nucleolus. Surrounding the egg cell are the smaller cells of the ovarian tissue. Upper right: the nucleolus has disappeared and the chromosome threads arrange themselves in a group ready to divide. Lower left: each chromosome thread has split lengthwise and half of each has pulled away from the other half, forming two separate groups. Lower right: each group has formed a new nucleus like the one in the first picture. The next step will be the division of the egg cell across the middle to form two new cells. Each of these will then develop again and again until the mature seed is produced. The fact that each new cell always contains half of all the elements (male and female) of the old cell explains the principle of heredity.

that it seems to us there can be no life in other parts of the universe without the same combinations—a benevolent sun, an atmosphere, vast quantities of water, etc. Given these, however, is there life in other parts of the universe? Nobody knows! But why not? It may be of course that there are not the same types we know—that there may be insects with four pairs of legs instead of three, and three pairs of wings instead of two; and humans with three pairs of limbs instead of two. You may imagine almost any forms you like; but nobody knows anything about it.

Space will permit but a few general considerations of the distribution and interrelations of living things in the world. In general the variety and wealth of *plant life* is on land, of *animal life* in the sea.

The Life of the Land and the Life of the Sea

All are familiar with the general conditions of life in the field and woods. The liberal vegetation, mostly of flowering plants, furnishes the fundamental food supply for animal life—insects, birds, mice, rabbits. Even where predacious animals feed on other animals, the latter have fed on plants. The interrelations—"the web of life"—are extremely intricate. And so it is, in greatly magnified degree, in the tropical forest. One thinks there of the luxuriant dense matted vegetation, sheltering its teeming life of insects and tropical birds and other strange life of the jungle. Here the web of life is so intricate as to baffle the imagination.

In the sea all is different. While there is often much *plant life* in the form of seaweeds (flowerless plants), especially along rocky shores, the wealth of plant life of the open sea consists of the invisible microscopic forms, especially the *diatoms*. About the *animals* of the sea there is always a peculiar fascination due to their abundance, their variety, and their strangeness. They are everywhere. Even the colder seas are populated by immense numbers of marine animals in great variety. Often along the shore—rocky, muddy, sandy—there is a baffling wealth of animal life the world over. The open sea has many peculiar forms at the surface, and still more peculiar ones at the bottom, even down as far as five miles. Fishes that are half mouth; crabs and their relatives that are mostly legs and feelers; starfish and their numerous relations; even delicate jellyfishes and polyps are there. And think of the conditions at these great depths—the tremendous pressure of five miles of water; the icy cold, even in tropical seas; the absolute darkness, except that a good many forms are phosphorescent—for not a ray of light penetrates much beyond a few hundred feet; the absolute quiet—for waves penetrate but a few feet.

All of the food and energy for this animal life at the bottom of the sea is from or near the surface, and consists of the microscopic forms of plants, or the small animals that have fed upon them. Over perhaps a hundred million square miles of the sea bottom is a deep "ooze," consisting of the skeletons of micro-

scopic animals and plants that have rained down through the ages from the surface.

Many forms of life are peculiar to the sea. Whole branches of the animal kingdom are found here alone and have never found their way into fresh water. Such are all the various forms of starfishes and their relatives; almost all of the great branch which includes the jellyfishes and polyps; almost all of the sharks, and other branches which might be named. Most of the life of the sea is fed, ultimately, by the microscopic plants that grow at the surface. Upon these tiny plants feed microscopic animals and small crustacea, even some fishes; these in turn feed the larger animals, including fishes like the cod and sharks, and whales and porpoises and other cetaceans.

Lives that Live on Other Lives

Among the most interesting and important of the biological interrelations of organisms is that of *parasitism*. There is scarcely a common form of life but has its many parasites. We think usually of the worms of many kinds that infest the intestine of man and most backboned animals; and of the insects, and other parasitic forms in or on the bodies of most visible forms of both plant and animal life. But the most deadly parasites for man and many other animals are certain species of microscopic *bacteria* belonging to the plant world, and of *protozoa*, belonging to the animals. It is they that kill most of mankind and other animals. Bacteria cause some of the rot and blight diseases of plants, and their cousins, the *fungi*, cause the rusts and smuts of grains. But not all bacteria and fungi are bad; many are of great service in getting rid of the dead bodies of larger animals and plants that would be in the way if not removed (see Bacteria; Parasites).

The Mystery of Life's Beginnings

Two or three branches of biology deserve special mention because of their significance and suggestiveness. One of the most fascinating and mystifying is the study of the reproduction and development of animals and plants—their *embryology* (see Embryology). The coming into being of an organism, especially one of the higher animals, remains one of the unsolved mysteries. Of course, it is popular knowledge that the common forms of life arise from fertilized egg-cells, but it may not be so well known that this is just as true for an earthworm or an oak tree as it is for a man or a chicken. It is true for the whole living world that "like begets like"—that all plants and animals, simple as well as complex, arise only from parents like themselves. The simplest forms of animal and plant life consist of a single cell; and they multiply merely by the single cell cutting itself in two, as described for the amoeba (see Amoeba). It seems hard to realize, however, that a human being, with its infinitude of characters, can arise from a tiny egg only a hundredth of an inch in diameter. It seems wonderful, too, that of three eggs, so nearly alike in size and appearance that it is difficult to tell them apart, one may give rise to a

starfish, one to an earthworm, and the third to a human being. In reality these three eggs are very different from one another.

The origins of the higher forms of life seem so natural to us now that it is hard to realize that people formerly believed that even complex animals such as earthworms and frogs, arose by spontaneous generation," that is from non-living matter without parents. It is only in recent years however that science has proved that the origin of life is the same for the simplest forms as for the highest—for the infinitely small germs of tuberculosis or malaria and the whole multitude of plant and animal germs that have heretofore killed a large majority of mankind as for mankind itself. At present it can be said that man has never created even the simplest form of life or seen it arise spontaneously. Of course a Burbank can perform wonders in *modifying* the common forms of plant and animal life, but can never create it.

"His Mother's Eyes and His Father's Chin"

Genetics is a comparatively new branch of biology which deals with the laws of inheritance. It dates back only to the beginning of the 20th century but it has received a great deal of attention in all countries. In 1900 scientists realized that Gregor Mendel, an Austrian monk working with peas nearly 40 years before, had discovered some general laws of heredity of very great importance and very wide application. The amazing thing is that Mendel's laws, found for peas, have since been found to hold good for many highly specialized plants and animals—even for some of the characters of man himself—such as the color of his hair and eyes etc. How wide the application is, especially for man, has not yet been fully determined. While Mendel's laws do not apply to all characters of plants and animals, they are known to be of sufficiently wide application to be of very great importance in the improvement of domestic plants and animals.

It is common knowledge that plants and animals inherit the minutest characters from their parents. The amazing thing is that all the infinitude of these characters, large and small, are carried by an unbelievably small amount of matter in the fertilized egg. Science tells us that all of the people in the world at any one time have had their heredity carried by a total of less than an ounce of matter. Think of the wonder of the development of a human being with all his infinitude of characters—his features, color of his hair and eyes, temperament, traits of character, and ability. Or of a great redwood tree, that is to live for several thousand years!

Stories that the Rocks Tell Us

Many plants and animals with hard parts have left remains in the rocks of the earth's crust which are called "fossils." The study of such remains is a branch of biology called *paleontology*, although this study is oftener connected with geology, the science of rocks. Paleontology more than any other science shows us the history of life in the world through all

of the millions of years of the infinite past. One of its most interesting revelations is that there are many forms of life that developed and flourished for ages, and then entirely disappeared from the earth. These include giant lizards more than 50 feet long, huge flying reptiles and grotesque monstrous mammals, giant mosses the size of trees. It shows us the stages in the evolution of the horse from ancestors the size of foxes. A thousand appealing things are shown by the study of fossils. Large parts of some kinds of rocks are formed by these remains of plants and animals. The great deposits of chalk, for example, often thousands of feet thick, consist almost wholly of the skeletons of microscopic animals.

The Great Discoveries of Recent Years

Several phases of biology may best be referred to by a brief history of the science during recent times. Great improvements in the microscope as well as other improvements, along with the growth of science in general, made possible enormous advances in the science of biology during the 19th century. By far the larger part of what is now known of this subject is recent knowledge amounting to a revolution in the science.

(1) One of the first of these great advances was the realization that all plants and animals are made up of *cells*—that the cell is the unit of structure in all living things. In the simplest forms of life, both animal and plant, the whole organism is but a single cell. In all higher forms of life, man for instance, the body is composed of millions and millions of cells, of many kinds, each kind specialized for some special use—muscle cells for motion, gland cells for secretion, etc.

(2) Following shortly upon the statement of the cell theory was the recognition that the essential part of a cell is its jelly-like substance which we now call *protoplasm*, and that this material is much the same in all living things, although differing infinitely in details in different types of animals and plants, and in different parts of the same complex organism. When the egg develops into the human body, for instance, the protoplasm gradually becomes different in the various types of cells.

(3) The greatest advance in biology followed Charles Darwin's statement of the doctrine of *organic evolution* and the publication of his 'Origin of Species' in 1859. The rapid acceptance of the view that living things are changeable, and that the diversified forms of life—of both animals and plants—have arisen by gradual changes from simpler forms, has had a very profound influence upon all fields of biological study (see Evolution).

(4) *Physiology* is the study of properties, activities, and functions in living things. Formerly it was limited almost wholly to man, and was mainly a part of medical study. With the general growth of biology, physiology has been extended to the study of all living things. This has brought great benefit to medical science itself, for a large part of what is

now known of human physiology was first worked out upon animals. Fuller knowledge of plant physiology has been of great benefit to agriculture.

(5) Between 1865 and 1890 came many revolutionary discoveries by Pasteur and other workers, showing that *fermentations* and *putrefactions* are caused only by minute organisms. These always come from the outside and never arise spontaneously. Pasteur and others proved that most of the diseases of mankind and other animals are caused by these infinitely small animal and plant parasites which we popularly call germs (see Pasteur; Disease).

Reasons for Classification

The least spectacular side of biology, but one that is of fundamental importance, is the problem of arranging the various kinds of plants and animals in some orderly fashion. Modern classification of living things is called the science of *taxonomy* (from the Greek *taxis*, meaning "arrangement," and *nomos*, meaning "law"). Taxonomy not only catalogs all forms of life by giving them distinctive names but also arranges them in natural groups that show relationships.

According to the present system of classification, most living things are separated into two *kingdoms*, the plant kingdom and the animal kingdom. Each of these is subdivided into certain grand groups, *subkingdoms* and *phyla*, which place together the organisms that seem to be constructed on the same general plan. Each phylum is arranged into *classes* composed of organisms, which differ in some constant feature. Each class, in turn, consists of *orders*. Closely related groups within the orders are termed *families*. Each family is composed of *genera*. Within the genera are the smallest groups, or *species*.

Exactly what constitutes a species is a matter of debate; but in general, a species includes individuals capable of interbreeding. The scientific name of a

species is always a double name, such as *Rana catesbiana*, the bullfrog, or *Quercus alba*, the white oak. The first name shows the genus, the second the species. Sometimes slight differences, such as coloration or size, are used to separate species into still lower groups known as *varieties*. These are designated by adding a third name. Thus, *Papilio glaucus* (variety) *turnus* is a dark form of the great yellow- and black-striped swallowtail butterfly.

In some cases, finer divisions are made of a complicated group; orders are split up into suborders. Families are divided into subfamilies, and so on. Family names of animals usually end in *idae*, as *Canidae*, the dog family; of plants in *aceae*, as *Rosaceae*, the rose family.

The following example shows how the bullfrog is classified under this system:

Kingdom, *Animalia*: all animals.

Phylum, *Chordata*: vertebrates and their kin.

Subphylum, *Vertebrata*: vertebrates only.

Class, *Amphibia*: frogs, toads, salamanders.

Order, *Anura*: tailless amphibians.

Suborder, *Firmisternia*: frogs only.

Family, *Ranidae*: true frogs.

Genus, *Rana*: certain true frogs.

Species, *Rana catesbiana*: the bullfrog.

Many scientists have contributed to the scheme of plant and animal classification, but the work of Linné is noteworthy above all others (see Linné). Linné brought order to botany and zoology by arranging organisms into genera and species. He introduced the principle of binomial nomenclature which has been universally adopted. By international agreement, the scientific name of a plant or animal must be the first specific name applied to it. To avoid international confusion, the names are derived from the Greek and Latin languages or from proper nouns which are given a Latinized form.

REFERENCE-OUTLINE FOR STUDY OF BIOLOGY

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II. Anatomy and physiology—the studies of structure and function A-239, P-245

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BIOMETRY. The application of mathematical and statistical methods to the description and classification of biological characteristics is known as biometry. Biometry differs from other statistical fields only in respect to the subject matter with which it deals.

Like other statisticians, biometricians are concerned with the collection of mass observations. They attempt to order these observations and summarize them. From the summaries they form general descriptions that will hold for the entire group of which those observed form a part. Biological data are extremely variable. Biometric methods have been developed primarily to overcome obstacles to exact reasoning caused by this variability.

Biometric methods are applied to the investigation of most of the biological and physiological characteristics of man and the plants and animals that are useful or dangerous to him. Biometric investigations of these characteristics range from the bearing qualities of fruit trees to the beneficial or harmful effects of drugs such as the sulfa group and the anti-histamines.

Extensive use of biometric techniques is made by research workers in biological science, zoology, botany, bacteriology, and physiology as well as in applied sciences such as entomology, fisheries biology, horticulture, and agronomy. Some medical reports are attempts to apply biometric methods to the study of human beings.

Many problems in the fields of pharmacology and clinical medicine have been solved with biometric techniques. The methods have proved useful also in determining such things as the most effective methods of control of animal and plant parasites, fungus diseases, and insects such as the common house fly, ant, and tick. Analyses of the chemical composition of soil have been related to plant growth. The relative effectiveness of different fertilizers and the usefulness of various weed-control agents have been determined.

Life insurance companies use biometric methods to calculate the probable duration of human life as a basis for life insurance premiums (*see Insurance*). *Mortality* statistics are studied with regard to age, sex, race, and cause of death. *Morbidity* statistics are concerned with cause of illness or injury. Life insurance companies have also made studies of mortality in relation to body build, medical history, physical condition, occupation, place of residence, and marital status. Such studies are made from the records in the files of insurance companies and also from records of the general population and clinical investigators.

Some insurance companies study trends in birth rates by age of mother and order of birth of children, as well as other factors in family organization and relationships. They are also concerned with the breaking up of the family relationship, particularly by death.

Sir Francis Galton (1822-1911) is considered by many to be the founder of biometrics. He was interested in the inheritance of mental ability and the relationship, or correlation, of individuals of like heredity (that is, fathers-sons) with respect to this characteristic. In the course of his investigations he applied already known mathematical methods to these problems and also developed new methods. He is probably best known for his introduction of regression and correlation techniques into the study of such relationships.

Galton's methods were further extended by Karl Pearson, R. A. Fisher, and others. After the appearance of Fisher's 'Statistical Methods for Research Workers', in 1925, the methods of statistical analysis were extended rapidly. The initial contributions of workers in biometrics were primarily in the methods by which samples of characteristics of plants and animals could be efficiently described and related. More recent advances in biometry have been directed to the problem of how to design efficient experiments to solve biometric problems with rela-

tively small samples of measurements R A Fisher and George Snedecor have been markedly successful in solving this problem particularly in the field of agricultural experimentation The results of many biometric investigations are published in *Biometrics* the journal of the Biometric Society (See also *Graphs*)

BIRCH The slim graceful birch with its creamy bark and dainty yellow green leaves gives an appearance of delicacy which it little deserves It is in fact extremely hardy No tree grows farther north than the birch and it is often the first to sprout up in burned and cutover areas

Birch bark is so heavily charged with resin that it is practically waterproof Long after the wood of fallen trunks has rotted away the encircling bark remains sound This quality made it valuable to the American Indians as covering for their canoes The paper or canoe birch was preferred because the bark peels off in great slabs (see Canoes and Canoeing)

The wood of the birch is very hard and close-grained The beautiful reddish brown heartwood of the yellow and the sweet birch is used in the manufacture of furniture for interior finishes and for veneers From the white wood of the paper birch are made spools barrel staves crossties and paper pulp Sweet birch and yellow birch yield an oil similar to wintergreen oil Birch is also used in the production of wood alcohol

The birches (genus *Betula*) number about 40 species of trees and shrubs scattered throughout the

Northern Hemisphere The paper or canoe birch (*Betula papyrifera*) is the most widely distributed It ranges from the lower Arctic regions to the northern United States from New England to the Great Lakes states A subspecies the western paper birch is found from northern Montana to eastern Washington Another subspecies the Kenai birch grows in Alaska The paper birch is a medium-sized tree 50 to 80 feet high that seldom lives more than 150 years

The yellow birch (*Betula lutea*) is the most important commercial species Its range is southern Canada northeastern and northern United States as far west as the Great Lakes states and south in the Appalachian Mountains to Georgia Under favorable conditions it reaches a height of 100 feet and may live 300 years

Sweet birch or cherry birch (*Betula lenta*) reaches its best development in the Appalachian Mountains The bark which suggests cherry in color and appearance does not peel as does the bark of most other birches River water or red birch (*Betula nigra*) is the southernmost species found on the banks of streams from New England to Minnesota and south from eastern Texas to northern Florida White or gray birch (*Betula populifolia*) a small tree 20 to 30 feet high is found chiefly in southeastern Canada and northeastern United States It is especially plentiful on abandoned farms and burned-over land The western red birch (*Betula fontinalis*) a small shrubby tree grows in the Rocky Mountains and in the Sierra Nevada and east to the Black Hills

THE SLENDER GRACE OF THE BIRCH



The leaves of the birch are oval with saw toothed edges In winter and spring tassellike catkins the pollen producing flowers appear at the tips of the twigs Near each cluster is an upright flower which receives the pollen and develops into



a cone bearing winged seeds Some of the birches such as those shown at the right are among the most beautiful trees with their white or creamy gleaming bark and their slender gracefully drooping shape These trees are yellow birch

Our Charming NEIGHBORS in FEATHERS

BIRDS. No creatures are more beautiful and useful than the birds. They serve us well by destroying insect pests and weed seeds. But they also serve through the pleasure they give us. Their varied colors, their graceful flight, their musical songs never fail to delight us. And we are fascinated by their mysterious yearly migrations. What message tells them when to leave and where to go? How do they learn the long way over thousands of miles?

Birds also give us marvelous chances for study. As yet nobody knows much about their daily lives. Every bird lover can make valuable scientific discoveries if he wishes by simply watching one bird and carefully recording its day-by-day activities. No study will pay more in healthful outdoor activity, in the joy of seeing beauty, and the satisfaction of adding to knowledge.

Adaptations to Flying

Of all animals, birds are most easily classified. They are the only ones that have feathers (see Feathers). Feathers make an outer covering, just as scales cover fish and reptiles, and hairs cover mammals.

With the fishes, reptiles, amphibians, and mammals, birds make up the division of the animal kingdom known as *vertebrates*, or animals having backbones. Scientists believe that birds evolved from a reptile-

like ancestor (see Reptiles). Then later, as the bird learned to fly, many changes took place in its body. Such changes are called *adaptations*. Unlike

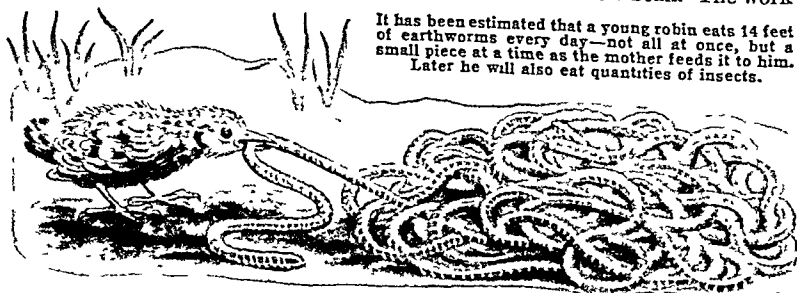
their reptile ancestors, birds have warm blood to give them energy. By comparing bird skeletons with those of related animals, we can see other important changes. A flying body must have the greatest possible lightness, compactness, and strength. The large bones of a bird are hollow. They also have air sacs which connect with the lungs. In some powerful, long-distance fliers, such as the albatross, practically every bone is air-filled. The body gains additional strength from having many adjoining bones shortened and fused into one. The vertebrae of the backbone are fused with one another and with the pelvic bones. The ribs are fused into a firm support for the down beat of the wings.

The outlying parts of the body, such as the head, tail, wings, and legs, are extremely light. The heavy muscles which operate them are massed close to the body. Only the tendons extend to the outermost parts. The bones of the skull are very thin. The bird's reptile cousins have teeth and jaws with heavy bones and muscles. Teeth have disappeared in the bird. Instead of a jaw, a bird has a hollow beak. The work of chewing is done by the gizzard, a part of the stomach where food is ground up. The many vertebrae which make up the tail of a reptile are shortened in a bird into one bone called the *pygostyle*. All the tail feathers, so important in flight, are attached to this bone. The ankle and foot bones are fused into one long slender bone called the *tarsus*.

SOME COMMON QUESTIONS ABOUT BIRDS

1. What is the largest living bird? The ostrich is the largest, but it does not fly. Of the flying birds, the wandering albatross has the greatest wingspread; the condor is the heaviest and largest in other respects.
2. What is the smallest living bird? The hummingbird.
3. Who are the champion divers among birds? The ducks called old squaws have been brought up alive in fish nets from a depth of 160 feet.
4. How far do birds fly? The Arctic tern makes an annual round trip of 20,000 miles between the Arctic and the Antarctic. Blue and snow geese make the longest nonstop flight—1,600 miles from James Bay to the Gulf coast of Louisiana. Many land birds, including the hummingbird, fly across the Gulf of Mexico to Yucatan, 600 miles.
5. How fast do birds fly? Most birds average 20 to 40 miles an hour in normal flight. They can almost double this speed for escape or pursuit. The champion is the duck hawk. It strikes its prey at 150 miles per hour and has been known to dive almost 350 miles per hour. The following speeds, in miles per hour, have been timed by stop watch, automobile, or airplane speedometer: golden eagle, 120; ducks, 55-70; geese, 50-60; pheasant, 60; quail 48-58; crow, top speed 60, normal speed 25 to 30; ruby-throated hummingbird, 55.
6. How fast do birds run? The following have been chased by automobile: Australian emu, 31 miles per hour; California road runner, 15 miles per hour; quail, 12 to 15½ miles per hour.
7. How long do birds live? Accurate records are not available. The United States Fish and Wildlife Service is gathering information by banding birds. As bands are recovered from dead birds, the dates of banding and recovery are noted. But few of the birds are banded as nestlings and their age at the time of banding is unknown. Hence nobody can give a "natural length of life," for birds. The problem is doubly difficult, because in nature most birds meet death by accident, hardship, or violence.
8. About how many birds spend at least part of the year on the North American continent north of Mexico? The number has been estimated as between 12 and 15 billion. It includes some 700 species.
9. How many species of birds are there in the world? More than 10,000.

very thin. The bird's reptile cousins have teeth and jaws with heavy bones and muscles. Teeth have disappeared in the bird. Instead of a jaw, a bird has a hollow beak. The work of chewing is done by the giz-



It has been estimated that a young robin eats 14 feet of earthworms every day—not all at once, but a small piece at a time as the mother feeds it to him. Later he will also eat quantities of insects.

which is the only part of the leg that usually shows below the feathers and to which the toes are attached. When we examine a bird's wing which is nothing more



One of the very earliest of the early birds the Archaeopteryx, now found on a fossil. There are four on each side clearly seen in the teeth in both jaws and the three claw bearing fingers on each wing.

than the bird's arm or front leg modified for the particular purpose of flight we see how few heavy muscles are borne upon it. The strong muscles that manipulate the wings are attached to the keel of the breastbone forming the familiar meat of the fowl's breast and are thus brought close to the center of gravity. The unnecessary bones of the wrist and hand are refused only one finger remaining well developed though traces of two others have been retained. Thus we might go on examining every part of the bird's anatomy and we should discover in each case that while the original reptilian parts are still recognizable they have been transformed through the course of ages to make the bird a perfect flying machine.

Why the Reptile's Blood Turned Warm

Another great difference between birds and reptiles is that birds in common with the mammals are warm blooded animals. The chief difference between warm blooded and cold blooded animals is that the warm blooded have a constant temperature while the temperature of the cold blooded animals varies with that of their environment. It is for this reason that reptiles become very sluggish in cold weather a characteristic that would not fit in well with the needs of a flying bird. We may assume therefore that one of the most important changes that took place in the development from the reptile was the change from a cold blooded to a warm blooded condition. This change brought with it many accompanying changes in the life of the bird for it ordained that the bird's eggs also should be maintained at a constant temperature and that the temperature of the young should not fall below normal. This resulted in the need for incubation of the eggs the building of nests and the care of the young which form such a conspicuous part of the bird's life today. This likewise

one of the fundamental reasons for the comings and goings or the migration of birds which makes their study so fascinating for if they were still cold blooded animals they would undoubtedly hibernate during cold weather. It is also the reason for their insatiable appetites. It is because Mother Nature developed in them a bodily temperature much higher than that of man that their life processes go on at a much more rapid rate causing their ceaseless search for food.

The eyes of birds are very highly developed so that they can see great distances and follow rapidly moving objects. Thus a swallow or a night hawk dashing through the air at breathless speed is able to keep its eyes on a tiny insect which is also moving rapidly. The eagle or vulture soaring almost out of sight in the air will dart with the speed of a bullet to a tiny object a human eye would hardly notice at a distance of a hundred feet. Likewise birds can adjust their eyes for different distances much more quickly than can other animals.

What We Owe to Our Feathered Friends

This ceaseless search for food gives birds their great economic value for it enables mankind to compete with the hordes of insects for mastery of the

earth's surface. Without the birds not only would successful agriculture be impossible but the destruction of the greater part of the vegetation would follow. We can appreciate the meaning of this statement by H. W. Henshaw former chief of the United States Biological Survey if we stop to consider the great reproductive capacity of most insects particularly those that feed upon vegetation and are therefore dangerous to crops.

The common potato bug if left undisturbed is capable of producing 60 million offspring in a single season. A common plant louse which brings forth living young has such a short life cycle that there may be 13 generations in a single season and inasmuch as



The Hoatzin of the Amazon Valley is the nearest living approach to the Archaeopteryx. The young have claws on the wings with which they climb about the trees.

each female brings forth at least 50 young the number in the 12th generation alone would be 10 sextillion. If left undisturbed and given plenty of food it would take any insect only a few years to completely cover the earth with its offspring. The need of birds and other enemies of insects is therefore very apparent.

The astonishing



When the Hoatzin (also called the Amazon Parrot) grows up the wing claws are shed and the bird looks much like a pheasant. The remarkable bird is a native of the Amazon Valley.

number of insects consumed by birds has been discovered by examining the contents of crops and stomachs. Scientists also make interesting observations by watching individual birds through high-powered field glasses and counting the insects they eat, or by observing the food brought to the young in their nests. Birds require a much greater amount of food than do other vertebrates. Their temperature and rate of respiration are higher, and they are far more active.

Experiments have shown that young birds consume from one-half to their full weight of food, or even more, every day. One of the most remarkable cases of feeding on record is that of a house-wren which fed its young 1,217 times in 15 hours and 45 minutes. A pair of chickadees were observed to feed their young 40 times in 30 minutes; a pair of purple martins 312 times in a day; and a pair of rose-breasted grosbeaks 426 times in 11 hours. The crop of a grown flicker has contained as many as 1,000 chinch bugs at a time. A nighthawk's crop was found to contain 500 mosquitoes. Birds congregate in great numbers whenever there is a plague of insects. The gulls that saved the pioneer Mormons from ruin by a cricket plague were honored by a monument in Salt Lake City.

The information gained from scientific study of birds' food is put to very practical use. Mallard ducks are often introduced into swamps and ponds to rid them of mosquito larvae. Utah farmers have introduced California quail to fight the alfalfa weevil. And market gardeners occasionally put wild birds in their greenhouses to destroy the caterpillars and insects that infest their vegetables.

Birds also play an important part in the destruction of weed seeds and in the dispersal of seeds to new or barren areas. Here again, the number which they consume is remarkable. One bob-white stomach contained 10,000 pigweed seeds. That of a mourning dove contained 7,500 seeds of sorrel and 9,200 seeds of pigeon grass. Moreover, the number of insects or seeds found in a bird's stomach represents only one meal of many taken during the day. The United States Department

of Agriculture at one time set aside a tract of land in Maryland for the purpose of determining the value of birds on a farm. More than 600 bird stomachs were examined during the experiment. It was estimated that the birds destroyed 46,000 seeds per acre in 24 hours. The number of weeds thus eliminated from one farm in a year is enormous.

Carrying Seeds to Barren Lands

Not all seeds consumed by birds are destroyed, however. Many pass through the digestive tract unimpaired, to germinate again. Or the birds may disgorge them after they have eaten the fruit containing them. In this way many millions of seeds are being scattered broadcast. Hedgerows often spring up between fields along the line of fences or electric wires, where perching birds have deposited seeds. Many an old field, abandoned because of its barrenness, springs to new life with trees, flowers, and weeds that have grown from seeds scattered by the birds, although rodents and the winds also play a part in this work. Barren ocean islands are "planted" by birds from the mainland. Birds also carry seeds in mud adhering to their feet. Charles Darwin, the naturalist, reared 82 plants from one ball of earth on the foot of a partridge.

The destruction of rodents is a third service which birds perform for the farmer. Rodents feed chiefly on roots and green crops. The damage they do amounts to millions of dollars every year. They multiply very rapidly. The common meadow mouse is so prolific that the offspring of a single pair would in five years, if they all lived, number several million. Hawks, owls, and other predatory birds are nature's check upon the numbers of rodents. Each hawk or owl requires the equivalent of three mice a day, or more than 1,000 a year. Owls are far more effective than cats in clearing out a rat-infested barn. Rodent plagues, like insect plagues, are always accompanied by swarms of birds. On the other hand, a region that is stripped of its predatory birds by ruthless hunting or other means, invariably becomes infested with rodents.

A fourth way in which birds serve man is as game.

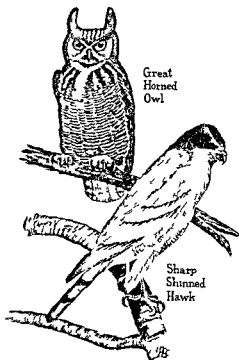
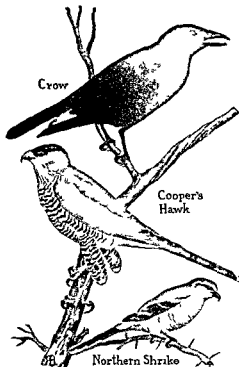
TABLE OF STATE BIRDS

| | | | | | |
|-------------|----------------------------|----------------|---------------------------|----------------------|------------------------------|
| Alabama | Flicker (Yellow hammer) | Massachusetts | Chickadee | Oregon | Western meadowlark |
| Arizona | Cactus wren | Michigan | Robin | Pennsylvania | Ruffed grouse |
| Arkansas | Mockingbird | Minnesota | Goldfinch (unofficial) | Rhode Island | |
| California | California valley quail | Mississippi | Mockingbird | | Bobwhite (unofficial) |
| Colorado | Lark bunting | Missouri | Bluebird | South Carolina | Carolina wren |
| Connecticut | American robin | Montana | Western meadowlark | South Dakota | |
| Delaware | Blue hen chicken | Nebraska | Western meadowlark | | Ring-necked pheasant |
| Florida | Mockingbird | Nevada | Mountain bluebird | Tennessee | Mockingbird |
| Georgia | Brown thrasher | New Hampshire | | Texas | Mockingbird |
| Idaho | Mountain bluebird | | Chickadee (unofficial) | Utah | California gull (unofficial) |
| Illinois | Cardinal | New Jersey | Eastern goldfinch | Vermont | Hermit thrush |
| Indiana | Cardinal | New Mexico | Road runner | Virginia | Cardinal |
| Iowa | Eastern goldfinch | New York | Bluebird (unofficial) | Washington | Willow goldfinch |
| Kansas | Western meadowlark | North Carolina | Cardinal | West Virginia | Cardinal |
| Kentucky | Cardinal | North Dakota | | Wisconsin | Robin |
| Louisiana | Brown pelican (unofficial) | | Western meadowlark | Wyoming | Western meadowlark |
| Maine | Chickadee | Ohio | Cardinal | District of Columbia | |
| Maryland | Baltimore oriole | Oklahoma | Scissor-tailed flycatcher | | Wood thrush |

Certain birds such as the grouse, pheasants snipe woodcock ducks and geese seem to serve man best by providing him with invigorating sport and food for the table. None of them are particularly important as a destroyer of insects and many of them become even harmful to agriculture if they occur in large numbers. Such birds are naturally prolific and when properly protected by game laws are able to withstand in suitable localities the losses which they

small fruits so that early strawberries raspberries and cherries often suffer from their depredations. Where there is a plentiful supply of the native fruits however or where many mulberry trees have been planted the cultivated fruits are left alone. Other birds that customarily feed upon weed seed often prove destructive in grain and rice fields so that it is necessary to frighten them away. Blank cartridges are as effective as the loaded ones and they have the

FIVE HIGHWAYMEN OF THE AIR



It all depends on your point of view whether you consider these feathered bandits as your friends or your foes. The Crow for instance at times eats the eggs of other birds and kills the young in the nests, but he also destroys an enormous number of harmful insects and expert agriculturists look upon him as a benefit to the farmer. The Great Horned Owl will occasionally dine on a young chicken but his usual fare consists of field mice which are enemies of crops. Not so much can be said for Cooper's Hawk and the smaller relative the Sharp Shinned Hawk for these live chiefly on birds and poultry. The Shrike on the other hand destroys great numbers of grasshoppers mice young snakes frogs etc. as well as an occasional sparrow. His habit of perching the bodies of his victims on thorns has won him the name of "Butcher Bird".

receive. Certain species like the ring-necked pheasant and mallard duck are being bred in captivity in large numbers and released where the natural supply of game has been greatly depleted. The subject of game breeding is receiving more and more attention in this country and is being encouraged by legislation so that in a few years it will undoubtedly offer an inviting occupation to young people interested in birds.

Although practically all birds are valuable to man in some one of the four ways mentioned there are a few that usually prove troublesome at certain seasons of the year. Most birds for example are fond of

advantage of preserving the birds to feed upon the insect pests the following spring and summer. Crows hawks and the great horned owl are enemies of the poultryman and the game breeder but otherwise they serve an important function.

The Delights of Bird Study

It is not merely because of their economic value however that birds are so extensively studied all over the world. Their cheerful songs their bright colors their many pleasing ways serve to draw thousands of people from lives of confinement or inactivity into the woods and fields in the pursuit of recreant on that is a health giving as it is fascinating. Those who are

unable to go far afield can, by suitably planting their grounds or offering food and water, attract dozens of these little feathered sprites close to their windows, where they can with little effort watch their many amusing and interesting ways and hear their cheerful songs. Though we may fix the dollar value upon the insects devoured by the little song sparrow, we can never estimate the wealth which his cheerful song brings to those that have an appreciation of birds. And it is the small birds who are the singers generally, while the large ones are of little or no importance as songsters.

The Geography of the Bird World

As soon as one begins to observe birds he discovers that the different kinds are found in different sorts of places. Some, like the robin and bluebird, are widely distributed in woodlands, orchards, and gardens throughout the country from Alaska to the Gulf, while others are restricted to certain localities or to particular environments. Thus the Ipswich sparrow nests only on Sable Island, Nova Scotia; and the Kirtland's warbler is found, during the summer, only in the jack-pine woodlands of central and northern Michigan. If one wishes to see rails, gallinules, and coots he goes to the marshes; and if he wishes to see bobolinks, meadow larks, and vesper sparrows he goes to the upland fields. The study of *local distribution* offers many interesting problems to the amateur as well as to the scientific ornithologist.

The study of the distribution of birds over the surface of the earth, or their *geographic distribution*, offers many other difficult and fascinating problems. If the world should be charted according to its families of birds rather than according to its races of people or its governments, it would make a strange map, because all the birds of the Northern Hemisphere are more closely related to each other than are the birds of many adjacent islands of the East Indies. Six main divisions or geographic regions have been recognized by ornithologists, as follows: New Zealand, Australian, Neotropical (South America), Indian, African, and Palearctic (North America, Europe, and northern Asia). While a few birds are found all over the world, and others in two or more of these regions, the vast majority of species and many whole families are restricted to some one of these geographic regions. In traveling around the world, therefore, we would expect to find greater difference between the birds of North and South America or between those of Europe and Africa than between those of Europe and North America. When we study the birds of the East Indian Islands, we discover some of the strangest facts of distribution, for a part of the islands lies in the Australian region and a part in the

Indian, and the line between the two is very sharp. Thus the islands of Bali and Lombok (in the Malay Archipelago just east of Java), though but 20 miles apart, differ as greatly in their animal life as do Africa and South America. This indicates that the two islands were separated at an enormously remote epoch, the deep strait between them being the dividing line between Asia and what was once the Australian continent. (See East Indies.)

In consideration of the geographic distribution of birds, the home of each species is considered to be that place where it builds its nest and raises its young, but many species migrate with the change of seasons from one region to another. Thus many of the North American birds spend the winter in South America, but do not nest there.

The Wonders of Bird Migration

In all the fields of nature study you will find nothing more wonderful than this seasonal migration of birds. The little bobolink that visits the northern United States in summer travels 5,000 miles over land and sea to his winter home on the pampas of southern Brazil. The golden plover wings a 2,000-mile flight over the Atlantic from Labrador and Nova Scotia to South America without a stop; while his relatives on the Pacific coast each year travel the 2,000 miles from Alaska to the Hawaiian Islands and back again. Not all birds, of course, migrate; for woodpeckers, nuthatches, chickadees, grouse, and a host of others are permanent residents of Canada and the United States. But robins and bluebirds, herons and ducks, warblers, flycatchers, thrushes, and hundreds of other species join the yearly migration from south to north and back (see Migration of Animals).

During the winter the birds travel about in scattered groups; and of course they do not nest, although a few of them sing fragments of their songs.

The Mating of the Birds

The sexes are often in distinct flocks. The reproductive organs are very small and nonfunctional. With the approach of spring the reproductive organs begin to enlarge and the birds begin to feel the instinct to move northward. The males are usually the first to start north, and arrive on the nesting grounds from a few days to a few weeks before the females. On arrival, the males usually select the general locations where they wish to nest and drive all rival males from these areas; at the same time they try to entice the females to remain and to mate with them.

Often a male returns to the same spot year after year, and frequently his former mate returns also and they remate for another year. This may occur until the death of one bird, when the surviving member

RARE VIEWS OF LIVING BIRDS

The color photographs on the next ten pages have been selected from the unique private collection of Dr. Eliot Porter. To find each nest with young birds in it, to arrange the lighting for clear, sharp pictures, and to catch the wary parents in natural attitudes—these things took years of skillful and patient work aided by exceptional knowledge of bird habits. The pictures cover a broad range of the United States from New England to the Southwest. Dr. Porter's camera has brought to every student of birds the kind of close-up, detailed views rarely obtained in the field even by the professional scientist.



By K. L. F. Porter

NESTING BIRDS—THE CEDAR WAXWING

In the ever-green forests of Canada and the northern United States the cedar waxwings build the nests. The one shown here may be male or female for the two sexes look alike. The waxed wings give the bird its name.



Photographed from life

By Elliot F. Porter

FOUR WARBLERS OF THE NORTHERN FORESTS

The black-throated green warbler (upper left), the redstart (lower left), and the magnolia warbler (lower right) nest in the top of high evergreens. The northern parula warbler (upper right) always makes its exquisite nest of usnea moss.



By E. J. F. Porter

Photographed from life

SMALL SINGERS OF FIELD AND WOODLAND

The red-eyed vireo (upper left) and the Baltimore Oriole (lower right) nest in lawn trees, orchards or woodlands. The white-breasted nuthatch (upper right) prefers a hole in a forest tree. The blue bird (lower left) will nest in a box.

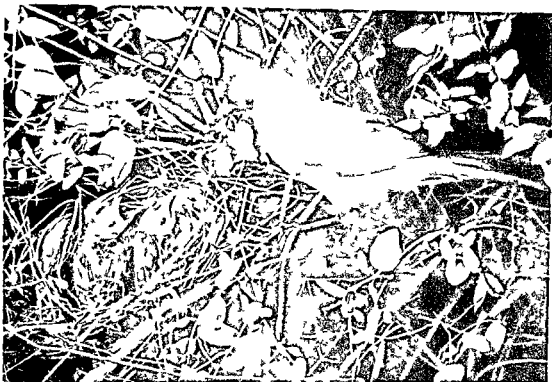


Photographed from life

By Elliot F. Porter

THE CATBIRD AND THE MOCKINGBIRD

The catbird (above) nests in the northern states, the mockingbird (below) in the southern states. The skill of these brilliant singers in mimicking the songs of other birds gives the name to the family to which they belong, the *Mimidae*.



Photographed from life

By Elliot F. Porter

THE CARDINAL AND THE BLUE JAY

The bl ant ex d nal (above) and h s no sy quarrelsome but beau ful ne ghbo the blue jay (below) seem to seek human compan onsh p Among he few b ds t at brave the no he n w n ers they a e almost as fam l s as the rob n

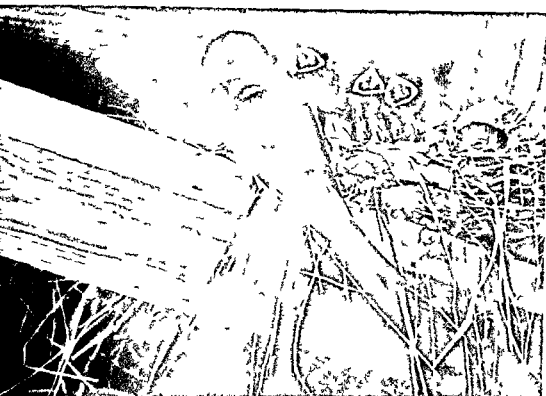


Photographed from life

THE TOWHEE AND THE BOBOLINK

By Elliot F. Porter

The red-eyed towhee (above) and the bobolink (below) nest on or near the ground. After the fall molt, the bobolink looks like a large sparrow. In this dull plumage it is known in the South, where it feeds on grains, as a reedbird, or ricebird.



Photographed from life

By E. W. P. Foster

BARN SWALLOW AND MEADOWLARK

The graceful barn swallow (above) builds its nests of mud and grasses on the rafters of a barn or other building. A clump of weeds conceals the beautifully finished nest of the meadowlark (below). These male birds help the females feed the large families.



Photographed from life

TWO BIRDS OF THE SOUTHWESTERN DESERTS

By Elliot F. Porter

The pyrrhuloxia (above) is a relative of the cardinal, familiar in the eastern states. It nests in mesquite thickets. The male has just brought food to the brooding female. The phainopepla (below) is related to the cedar waxwing. This is a female.



By Erik F. Porter

VERMILION FLYCATCHER AND HOODED ORIOLE

The vermilion flycatcher (above) is like a brilliant gleaming jewel among the dark leaves. The female hooded oriole (below) has built her nest of plant fibers among palm leaves. Both are birds of the southwestern states and Mexico.



Photographed from life

By Elliot F. Pratt

RESIDENTS OF WESTERN CACTUS THICKETS

The Palmer thrasher (above) and the road runner (below) both build nests of sticks inside a fortress of cactus spines. The thrasher's babies will soon be leaving the nest. The road runner is apparently offering his family a banded lizard for dinner.

ordinarily finds a new mate and often returns to the same nesting site. Thus a pair of orioles have been known to nest in the same tree for 33 years, but undoubtedly they were not the same two birds. Although monogamy or a single mating for the year is the rule, a few birds, akin to our common poultry such as the turkey, grouse, and pheasant are regularly polygamous—that is, each male is mated to several females. Polygamy occasionally occurs among other birds, especially the wrens and blackbirds. Cowbirds do not have permanent mates even for a single season as they do not take care of their own young but lay their eggs in other birds' nests. A bird of tropical America called the *ani* is regularly communistic—that is, the members of this species build a common nest in which several females lay their eggs, and all help to care for the young.

How the Birds Go Courting

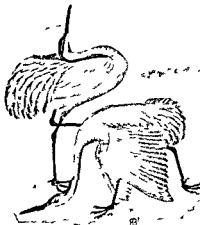
Mating is never accomplished without a more or less elaborate courtship. It is during this period that birds are seen and heard to the best advantage, for the male birds try to make themselves as conspicuous as possible, both by their songs and by the display of their plumage. Of course all birds do not sing, and a few—such as the storks, the pelicans, and the frigate birds—seem to be voiceless in adult life. True song is confined to the higher families of birds, and reaches its best development among the thrushes.

The vocal organs of a bird are somewhat different from those of man, for instead of having vocal chords located in the larynx at the upper end of the trachea or windpipe, they have simple membranes, which vibrate, located at the lower end of the trachea in a structure called the *syrinx*. The shape of this structure, and the number of muscles which control the tension of the membranes, vary with the different families of birds and produce the different songs.

Birds which are unable to sing usually have substitutes for song to announce their presence to the females. Thus the woodpeckers produce a loud tattoo by hammering with their bills upon a hollow limb or other resounding surface. The ruffed grouse produces a loud drumming sound by beating the air with its wings, and the woodcock produces a winnowing sound by mounting high in the air and zigzagging back to earth on set wings so that the wind whistles through the three outer wing feathers.

Even more interesting than the sounds produced by birds are the many curious displays of plumage and courtship antics. The display of the peacock, the turkey, and the domestic rooster are familiar to all, and many of the smaller birds can often be seen going through similar performances. Other birds, such as the pouter pigeons, the prairie chickens, and the European bustards have peculiar air-sacs which they inflate during their courtship giving them a very grotesque appearance. The European skylarks and our horned larks perform feats of flying during their courtships that are quite spectacular. After mounting to such a height that they are barely visible, and after hovering and singing at that dizzy height, they suddenly close their wings and drop like stones toward

STATELY COURTING OF THE CRANES



Nothing can exceed in stately ceremony the dances of these Sandhill Cranes. A traveler thus describes one of these very formal social events: The male suddenly wheeled his back towards the female and made a low bow his head nearly touching the ground and ending by a quick leap into the air. Another prouette brought him facing his charmer, whom he greeted with a still deeper bow, his wings meanwhile hanging loosely at his side. She replied by an answering bow and hop and then each tried to outdo the other in a series of spasmodic hops and starts mixed with grave and ceremonious bows.

the earth. One thinks they are about to dash themselves to pieces, when they gracefully spread their wings and alight, only to repeat the performance. Many of the albatrosses and cranes, and certain small birds as well, have elaborate series of hops, skips, and bows which might be likened to old-fashioned dances. Among the most elaborate courtship performances are those of the bower birds of Australia, which build little bowers of twigs or plant stems. These bowers are entirely distinct from their nests, and are usually decorated with bright berries, shells, or flowers, which are renewed as often as withered.

Choosing the Nesting Site and Building Materials

After mating, birds usually set about nest-building immediately. Although the male has already selected the nesting area, the female usually selects the exact nesting site and builds the nest, the male standing

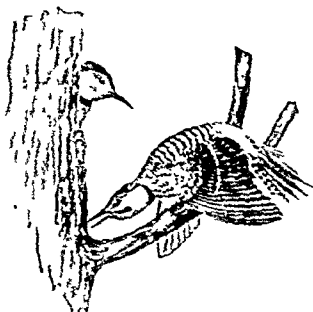
guard near by or accompanying her in her search for nesting material, and permitting no other male to approach within his precincts. The character of the nest depends upon the species of bird and the family to which it belongs. It has undoubtedly had its origin in the requirements of the young—how long they must use it and the dangers to which they are exposed—together with the intelligence of the bird in meeting these requirements.

When birds evolved from their reptilian ancestors, they undoubtedly at first laid their eggs as do the turtles and lizards today, burying them in the sand or hiding them in holes in trees. But as they became warm-blooded creatures and the need for incubation arose to keep the eggs at a constant temperature, it

was necessary to lay them above ground, so that they could be brought into contact with the bird's body. At first the birds probably did not even scratch depressions to keep the eggs from rolling about, but laid them on the flat ground as do the night-hawks and whippoorwills today. The next stage was doubtless the scratching of depressions to keep the eggs from rolling, and we find this stage represented today by the nests of the killdeer and other plovers. An advance from this stage was the addition of a lining to the depression, such as is seen in the nests of the sandpipers. Such nests, however, give little protection against long spells of wet weather or against the numerous terrestrial enemies. It is easy to imagine that the birds that learned to raise their nests above ground, first on piles of vegetation and then into bushes and trees, were more successful in raising their young, especially if the young had to remain in the nest for some time.

It is not difficult to select from the nests built by birds today a series which shows the probable evolution of nest architecture, from the crudest to the most elaborate. Thus, the simplest platforms of sticks are built in the trees by the herons, while the crows and hawks build more substantial structures of sticks with deeper hollows to hold the eggs and usually with linings of softer materials. Continuing up the scale we find the coarse twigs discarded for finer and softer materials, until we come to such nests as those of the yellow warbler or goldfinch, which are made almost entirely of plant downs or other woolly substances. The

THE FLICKER SHOWING OFF



The courtship antics of the flicker may be ridiculous to human eyes, but the female peering out of the nesting hole is charmed by her mate's jerky bobbings and wing spreading.

that they resemble knots instead of birds' nests. Robins, wood thrushes, and vireos weave in pieces of paper or cloth, to disguise their nests.

In selecting their nesting material, birds ordinarily take that which is nearest at hand, so long as it conforms to the type of the nest which that species builds. Thus field birds ordinarily use grasses and hairs, woodland birds use sedges and cattails. Birds like the oriole, therefore, which ordinarily use plant fibers, are quick to avail themselves of strings or yarn put out for them.

COURTSHIP OF HUMMINGBIRD.



When the hummingbird is courting, the female sits on a twig while the male bird swings before her in a great pendulum motion, backward and forward. He tries to swoop as near her as possible.

A GROUSE DRUMMING



This grouse is sending a "wireless" message to the female of the neighborhood by beating the air with his wings. This produces a peculiar drumming, whirring noise, recognized at a considerable distance.

highest type of nest is perhaps the beautifully woven structures of the oriole, hung at the tip end of a branch, though many of the simpler nests show curious specializations. The nest of the hummingbird and that of the wood pewee, for example, are covered on the outside with lichens and bits of bark, so

boxes instead of holes in trees; and the phoebe, that nests under bridges instead of on rock ledges; the barn and cliff swallows, that have deserted the cliffs for human habitations; and especially the omnipresent house sparrow, are examples of this power of adaptation.

How Long it Takes to Build a Nest

The time used to build a nest depends upon how much time the bird has before its first egg is ready to be laid. With ordinary birds the time required is about a week; but there have been many instances—when the first nest has been destroyed and the eggs are ready to be laid—of birds building their entire nests in a day. Occasionally birds that are permanent residents, such as the chickadees, or that arrive early in the spring, as do the phoebes, begin their nests long before the eggs are mature, and consume several weeks in building a structure that could be completed in a few days if necessary. At times certain birds simply mend old nests left the year before.

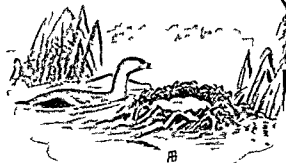
The eggs of birds are among the most beautiful creations of all nature. They vary in color from those



Murre

that are as white as snow to those that are almost black but the majority have a ground color of some delicate tint and are spotted or streaked with much darker colors. The yolk of the egg is formed entirely in the ovary of the mother bird, the albumen in the upper two-thirds of the oviduct, the shell in the lower third and the color in the lowest end of the oviduct or else in the *cloaca* just before it passes out.

Many theories have been advanced to account for the coloration of eggs. It is almost certain that the color as originally developed was of some value to the eggs, probably in rendering them less conspicuous for eggs like those of the woodpeckers and kingfishers that have always been laid in dark holes where the color would not be seen, are pure white. Eggs such as those of the plovers and terns on the other hand that are laid in exposed places with no protecting nest are colored like the soil or gravel and are very difficult to



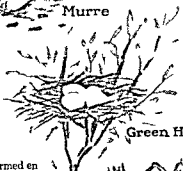
Pied-billed Grebe

find. The majority of eggs however that are laid in nests seem to be conspicuously marked rather than otherwise for they are white or some light tint in ground color. In such nests there is no need for protectively colored eggs because the bird ordinarily selects a site where the whole nest will be inconspicuous and thus hides her eggs at the same time. Thus it has come about that with the evolution of nests the need for protectively colored eggs has disappeared and the pigment has gradually degenerated causing the many beautiful but conspicuous eggs that we find today. Indeed it is the writer's belief that it is an advantage for nest building birds to have conspicuous eggs for if there is an enemy living in the vicinity that will sooner or later discover the nest it is to the bird's advantage to have it broken up as soon as possible so it can go elsewhere and try again before the season is too far advanced. If the nest remains safe through the first few days when the conspicuous eggs are left exposed it stands a good chance of remaining safe through the entire period.

Number and Size of Eggs

It requires about 24 hours for an egg to be formed so that ordinarily one egg is laid each day at about the same time until the normal number for the species is complete.

This number varies according to the dangers to which the eggs and young are exposed. Many seabirds that nest on inaccessible cliffs lay but a single egg while the majority



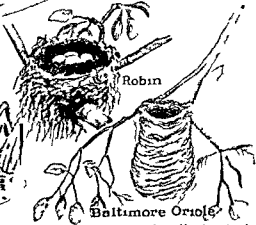
Green Heron



Sharp-shinned Hawk



Barn-Swallow



Robin

Baltimore Oriole

fast as in the building very widely as you can see here. That on one sea bird the Murre solves the problem by not making a nest at all. The single egg is laid on bare rocks but its peculiar top shape insures a safety for as soon as it starts to rotate the egg is so placed that you can trace the development of nest material in the other parts of the egg from the crude bundle of twigs piled roughly together by the Green Heron, to the wonderfully elaborate weaving done by the Oriole.

of game birds and water fowl, that have numerous enemies, lay from 10 to 20. The usual number for most birds is from three to five. If the last egg is removed from a nest as often as laid, the bird's ovary is sometimes stimulated to keep forming eggs in an endeavor to secure the normal number in the nest before the bird begins to incubate. Thus a flicker laid 74 eggs in 71 days, and the domestic fowl has been known to lay more than 350 eggs in a year.

The size of eggs is fixed for each species, and varies from that of the humming-bird, which resembles a small bean, to that of the ostrich, which is between five and six inches in diameter. Occasionally, with very old domestic fowls or at the close of the egg-laying period, very small eggs are laid. Occasionally also two or even three eggs become enclosed in a single shell, forming the so-called "double-yolked eggs." These abnormalities occasionally occur also with wild birds. In general the size of the eggs varies with the size of the bird, but birds whose young are hatched blind and helpless lay much smaller eggs than those whose young are covered with down and able to run about when hatched. Thus the catbird and the spotted sandpiper are about the same size, but the egg of the sandpiper is about twice the size of that of the catbird.

How the Egg Becomes a Bird

With the laying of the last egg most birds begin to incubate, but a few like the owls begin to incubate with the laying of the first egg, causing the young to hatch on different days. The time required for eggs varies with the size of the egg, though for some reason a few small eggs require a longer time than some of the larger ones. Thus, while the eggs of the red-winged blackbird require but 12 days, and the eggs of the robin but 14, the eggs of the humming-bird require 15 days to hatch. Hen's eggs require 21 days, ducks' 27, geese's 35, etc. In addition to being maintained at a constant temperature by the heat of the bird's body, the eggs have to be regularly turned by the old bird, and occasionally moistened to keep the pores in the shell open and the membranes which line the shell moist so that the embryo can breathe.

With most birds the work of incubation is performed entirely by the female, the male either feeding her on the nest or standing guard by the nest while she flies off to feed. With dull-colored or sparrow-like species, in which the males are as dully colored as the females, the males share the duties of incubation; and the same is true of a few brightly colored birds, like the rose-breasted grosbeak.

There are two types of young birds—those that remain helpless in the nest for some time, and those which can run about as soon as hatched. The first

class are hatched blind and helpless, with only a scant covering of down. Their parents build well-formed nests in which they remain for varying lengths of time—from a week in such ground-nesting species as the vesper sparrow and horned lark, to a year in such birds of flight as the condor and the wandering albatross. The young of the second class, on the other hand, like those of the domestic fowl, are fully covered with down when hatched, have their eyes open almost immediately, and are able to follow their parents about in their search for food. They remain in the nest only a few hours, and their parents must, therefore, be birds that live on the ground or in the water.

Taking Care of the Young

All young of the helpless type are fed at first on partially digested food brought up from the crop of the parent bird. Doves, petrels, albatrosses, and a few other birds continue this method of feeding as long as the young require care; but the majority of birds soon begin to bring fresh food to the young. This is usually carried in the bills or in the talons of the old birds; but herons, humming-birds, waxwings, and a few other birds continue to carry the food in their crops although it is not all digested.

The food of most young birds consists of insects at first, this being varied later by fruits or even seeds with some species. The insects are placed far down into the throats of the young birds, which normally stretch up their necks and open their mouths widely at the approach of their parents. Swallowing is entirely automatic, and unless food is placed beyond the base of the tongue, the muscles do not act and the food remains in the open mouth unswallowed. There is likewise a nervous

adjustment to prevent the young from being overfed, for after each has received sufficient food, the throat muscles refuse to work and the food remains unswallowed. After feeding, the parent bird always inspects the mouths of the young, which usually remain wide open, and if any food remains unswallowed, she removes it and gives it to one of the other young. As stated in the paragraphs on economic importance, the amount of food taken by young birds is surprising, for they require from one-half to their full weight of food each day in order to grow. To keep up this supply both parents work from early morning until nearly dark. In a few cases, like that of the humming-bird, the male bird never assists in the care of the young; but in most cases, the male is even more industrious than the female, and is likewise more courageous in the presence of danger.

After each feeding the nest is regularly inspected and all excrement is removed, so that the nest is

BABY BITTERNS



The babies in a Bittern's nest "come in sizes." The reason for this is that the parents begin hatching the eggs just as soon as Mrs. Bittern has laid the first.

time, and for a time the birds are unable to fly; but this is an exceptional form of molting. The summer molting season usually

begins in August and continues through a part of September. This is the most difficult season of the year to study birds, because during the molt they stop singing, seek seclusion, and many species seem to disappear altogether. During this molt every bird changes every feather on its body, and most birds that have been brightly colored during the breeding season now assume sober

colors. Thus the male of the scarlet tanager, which during the summer is bright red with black wings and tail, now becomes green like the female, except that his wings and tail still remain darker than hers. During the spring molt, only such feathers are replaced by birds as are necessary to bring them into breeding colors. Thus the scarlet tanager does not shed its wing and tail feathers, for they are the same in both plumages. Birds which have the same color in winter as in summer usually do not have a spring molt, since the feathers are not yet sufficiently worn to make the physical strain of molting worth while. Some birds appear to change their colors without molting by a process

called *feather wear*. This occurs only with such birds as have their new feathers edged with brown or gray; for these edges, by their overlapping, conceal the underlying main color of the feather. Thus the rusty blackbird appears largely brown in its winter plumage, but as spring approaches and the brown edges wear off, it gradually becomes blacker until, by the time the breeding season has arrived, its feathers are like jet. Often some prominent mark is concealed in this way during the winter, as for example the black throat patch of the male house-sparrow. This is a narrow spot all winter, but by May or June the entire throat is black.

READING CHARACTER IN BEAKS

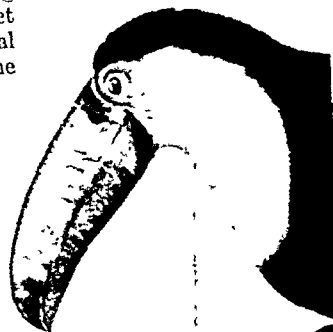
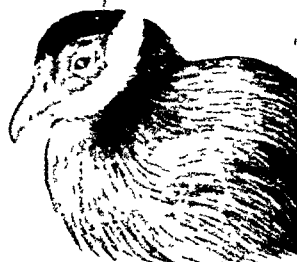
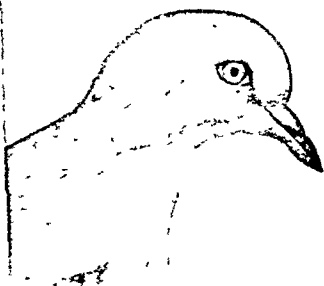
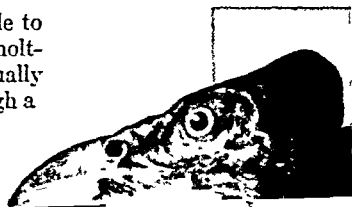
The shape of a bird's beak indicates the kind of food it eats—carrion, the flesh of other birds, seeds, fruit, or insects. The beaks of the hawk, vulture, and condor are fine for tearing meat. The pigeon and the pheasant have beaks suited to picking up small seeds. The cockatoo has a diet of nuts, hard-shelled insects, small lizards, and fruit. The maleo bird of the Celebes digs in soil

for worms and insects. The swan can cut and crush the roots of water plants. The toucan's huge beak, formed inside like a dry, light sponge, is a mystery. It eats ordinary fruits and insects.

(Painting by Jean Eitner)

Cockatoo
Cooper's Hawk
Common Pigeon
King Vulture
California Condor

Maleo Bird
Mute Swan
Eared Pheasant
Toucan
Turkey Vulture

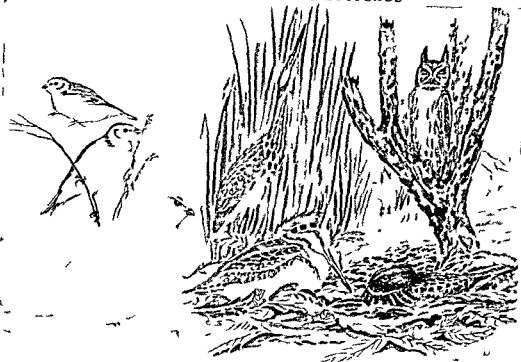


It is impossible to imagine a color that could not be matched by the plumage of some bird, but in spite of this fact there are only four pigments or color substances found in the feathers of birds—black, brown, red and yellow. In a small group of African birds called turacos a green pigment also occurs, but all other greens and all blues and metallic colors are due to the structure of the feathers rather than to pigments. It is usually the superficial layers of cells that are prismatic in shape and cause the refraction

birds appear much redder than the normal coloration irrespective of age or sex. This is well shown in the red and gray phases of the common screech owl and in certain other dull colored species.

When there is a difference in the coloration of the male and the female bird it is usually the male that is lighter. Among North American birds the phalaropes (a group similar to the sandpipers) are exceptions to this rule, the females being brighter than the males. It is interesting to note in this case

HOW BIRDS PRACTICE CAMOUFLAGE



You might wonder why those two Snow Buntings aren't all white, but don't you see how those dark patches of color would help them to blend in with a background of snow-covered bushes so that a hawk for example swooping in the sky couldn't make them out at all? The Ptarmigan just below is all white because he is directly on the snow. The Bittern, with a head as light as among the tall grass of a marsh, is easily confused with his surroundings, and the same is true of the blending of the Woodcock's markings and the dead leaves. The Screech Owl is doing it daylong on a dead tree, looks to be a part of it, while the Whippoorwill crouching below seems a part of the mottled soil.

that gives the color to the feather. To see the color at its best, therefore, the observer has to be in good light with the sun at his back. It is for this reason that a bluebird appears black when it is between one and the sun, and it is also for this reason that it is often difficult to identify the birds one sees under unfavorable light conditions.

Occasionally birds are seen whose feathers are deficient in pigment. There may be only a few white feathers in the plumage, or the entire bird may be spotted or it may be entirely white. In the latter case it is said to be a pure *albino*. Albinism may occur in any species. In a few species the red pigment occasionally becomes overdeveloped and the

that the males incubate the eggs and care for the young while the females go off by themselves for it is believed that the dull coloration of most females is due to the need for being inconspicuous on the nest. Added strength is given to this belief by the fact that in the families of birds that always nest in holes, notably the woodpeckers and kingfishers, the females are just as brilliant as the males. Being out of sight when incubating they do not need to be protectively colored.

When the males and females are colored differently in the breeding season, the male in its winter plumage usually takes on a coat very similar to the female. It is for this reason that so few brilliantly colored

birds are seen during the fall migration and during the winters spent in the south.

When the male and female differ in color, the young birds in juvenal plumage usually resemble the female. If both sexes are alike, the young are similar, unless the adults differ in coloration materially from the other members of the family. In such cases the young often show the characteristics of the family. Thus young robins and bluebirds have the spotted breasts characteristic of the thrush family, and young field and chipping sparrows have the streaked breasts of the sparrow family, although the adults in both cases have unmarked underparts. The juvenal plumage is usually lost after the first winter, in time for the first breeding season; but a few birds like the redstart and orchard oriole do not change until after the breeding season. It is for this reason that one often sees individuals that seem to be females of these species singing, though they are in reality young males.

Bird "Camouflage"

When one begins the study of birds he very soon realizes that some birds are much more easily seen than others. He soon learns that certain birds, such as the tanagers and warblers, are quite conspicuously marked; while others, for example the sparrows and shore-birds, are protectively colored. The conspicuously marked birds are ordinarily shy birds and do not permit of very close approach, while those that are protectively colored will often allow you almost to step on them before taking wing.

This form of "camouflage" among birds is an interesting example of the manner in which Nature safeguards animals from their foes (see Protective Coloration).

There are today between 13,000 and 14,000 species of birds found in the world, of which 766 are found in North America north of Mexico. Before anyone can handle conveniently any such large group of

objects or facts, it is necessary that they be systematically arranged, and this arrangement is called classification. Just as the books in a library are classified and placed on shelves according to their contents and

relationships, so in the classification of birds—and indeed of all animals—the endeavor is made to put similar animals together in groups, and similar groups together in larger groups, etc. And just as in the library the books are not arranged according to their size or the color of their covers, so with birds—their classification is based upon their structure rather than upon external similarity.

Beginning with the largest groups, we find that the animal kingdom is divided into a number of *phyla* (from the Greek word meaning "tribe") or branches, of which the birds, together with the mammals, reptiles, amphibians, and fishes belong to the highest group, called *Chordata* or backboneed animals, as opposed to the insects, mollusks, crustaceans, etc. Each phylum is divided into a number of *classes*, the birds belonging to the class *Aves*. Each class in turn is divided into a number of orders, and these are again divided into *families*. Twenty of these orders are represented by the birds of North America north of Mexico as given in the accompanying table.

Some of these families are represented by only one or two species in North America, while others contain 40 or 50. In the larger families certain species are always more like each other than like the other members of the family, and so it has been found convenient to divide each family into *genera* (singular, *genus*). Thus in the thrush family we have a genus to include the various bluebirds, another to include the various robins, another to include the various thrushes, etc.

A species has been defined as a group of individuals that resemble each other as the offspring of a single parent, and would naturally be the smallest division necessary for all ordinary usage. However, in studies of the distribution of birds, it has been discovered that species

of birds that have a wide range over the continent usually vary in different parts of their ranges, and, in order to show to which local race an individual bird belongs, it has been necessary to divide the species into sub-species or varieties.

ORDERS OF AMERICAN BIRDS

- I. Order *Gariiformes*: Loons.
- II. Order *Colymbiformes*: Grebes.
- III. Order *Procellariiformes*: Albatrosses, Shearwaters, Fulmars, Petrels.
- IV. Order *Pelecaniformes*: Tropic-birds, Pelicans, Boobies, Gannets, Cormorants, Darters, Man-o'-war birds.
- V. Order *Ciconiiformes*: Herons, Bitterns, Egrets, Storks, Ibises, Spoonbills, Flamingos.
- VI. Order *Anseriformes*: Swans, Geese, Ducks.
- VII. Order *Falconiformes*: Vultures, Kites, Eagles, Hawks, Ospreys, Caracaras, Falcons.
- VIII. Order *Galliformes*: Guans, Grouse, Quails, Pheasants, Turkeys.
- IX. Order *Gravimiformes*: Cranes, Limpkins, Rails, Gallinules, Coots.
- X. Order *Charadriiformes*: Oyster-catchers, Plovers, Turnstones, Surf-birds, Snipes, Sandpipers, Curlews, Godwits, Dowitchers, Willets, Avocets, Stilts, Phalaropes, Jaegers, Skuas, Gulls, Terns, Skimmers, Auks, Murres, Puffins.
- XI. Order *Columbiformes*: Pigeons, Doves.
- XII. Order *Psittaciformes*: Parrots, Paroquets, Macaws.
- XIII. Order *Cuculiformes*: Cuckoos, Road-runners, Anis.
- XIV. Order *Strigiformes*: Owls.
- XV. Order *Caprimulgiformes*: Goatsuckers, Nighthawks.
- XVI. Order *Micropodiformes*: Swifts, Hummingbirds.
- XVII. Order *Trogoniformes*: Trogons.
- XVIII. Order *Coraciiformes*: Kingfishers.
- XIX. Order *Piciformes*: Woodpeckers.
- XX. Order *Passeriformes*: Perching Birds, including almost half the known species.

Each order is divided into one or more families. Thus the order *Passeriformes* is represented by some 25 families in North America, as follows: *Tyrannidae*, Tyrant Flycatchers; *Auladidae*, Larks; *Hirundinidae*, Swallows; *Corvidae*, Jays, Magpies, and Crows; *Paridae*, Titmice, Verdins, and Bush-Tits; *Sittidae*, Nuthatches; *Certhiidae*, Creepers; *Chamaeidae*, Wren-Tits; *Cinclidae*, Dippers; *Troglodytidae*, Wrens; *Mimidae*, Mockingbirds, Catbirds, and Thrashers; *Turdidae*, Thrushes, Bluebirds, and Solitaires; *Sylviidae*, Gnatcatchers and Kinglets; *Molacillidae*, Pipits and Wagtails; *Bombycillidae*, Waxwings; *Polioptilidae*, Silky Flycatchers; *Laniidae*, Shrikes; *Sturnidae*, Starlings; *Vireonidae*, Vireos; *Compositellidae*, Wood Warblers; *Ploceidae*, Weaver Finches; *Icteridae*, Meadowlarks, Blackbirds, and Troupials; *Thraupidae*, Tanagers; *Fringillidae*, Grosbeaks, Sparrows, and Finches.

How to Recognize Some of the Common Birds

LEARNING to identify birds is a fascinating game of skill. Each different kind (species) has a distinctive size, color, pattern of markings, shape of wing, bill and feet, song and call note, and habitat (the kind of place in which it lives). The pictures on this and the following pages include some of the common North American birds, and the legends tell you something about them. The articles appearing on other pages under each bird's name should also be consulted.



THIS is the common Tern or Sea Swallow* (*Sterna hirundo*) that tells the fisherman where to cast his nets. Feeding on the small fry that are driven to the surface by their larger foes, the Terns gather in screaming thousands over passing schools of fish. In snatching their prey from the waves they rarely wet more than their heads and necks. The Terns belong to the order *Charadriiformes* which includes also Gulls, Jaegers, Skuas, Shore Birds, Auks, Murres, and Puffins.

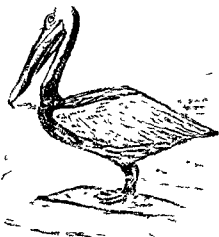
BEGINNING with water birds we see first the Pied-billed Grebe or Hellyer's (*Fodymbus podiceps*) a far better swimmer than any duck. Like a submarine it can float with its whole body showing or sink until only its sharp eyes are visible. The Grebes or lobe-footed divers form the order *Columbiformes*. Other common members of this group are Hairy Grebe, the Horned Grebe, the Eared Grebe and the Western Grebe.

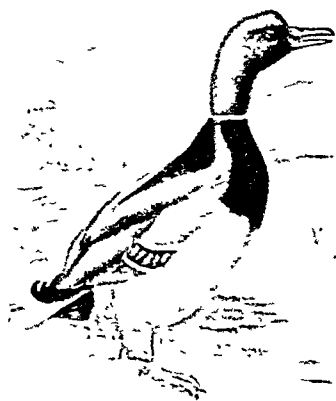


THE solemn-looking bird below is the Brown Pelican (*Pelecanus occidentalis*) bulky, powerful wing and a great fisherman. It flies low over the water, turning its head from side to side in the most comical manner, and plunging in like a stone when it sights a flash of silver near the surface. Its appetite is enormous and when it can swallow no more it fills the great pouch beneath its beak with fish to be eaten later at leisure or to be fed to its young. Often the Laughing Gull, a relative of the bird in the next corner, watches until the Pelican is struggling with a new caught fish, then alights on its great back and snatches the prey away. Pelicans frequently travel across country in regular wedge-shaped lines, beating their wings in perfect unison. The White Pelican is a more showy bird than the brown and is commoner in northern regions. Pelicans are members of the order of yoke-footed swimmers (*Pelecaniformes*) which have all four toes joined by webs. The Gannets, the Darters or Water Turkeys, the Cormorants and the Frigate birds or Man-o-War birds, also belong to this order.



SQUARE tails, larger and stockier bodies, broader and less pointed wings—these marks distinguish the Gull from the close relatives, the Terns. The Herring Gull (*Larus argentatus americanus*) shown here with its darker colored young, is one of the commonest of the Gull family. Besides fish it also feeds on carrion or on any scraps of food thrown overboard by ships. It is the most familiar bird in large harbors where it boldly flashes its brilliant white breast in the wake of churning vessels or feeds the choppy waves like a cork. It is a skilful opener of clams, dropping them again and again from high in the air to the hard beach until the shells crack.





ALL sportsmen know the Mallard Duck (*Anas platyrhynchos*), for it is the chief water-fowl of most wild duck preserves. The bright green head and vivid markings of the male make him a conspicuous figure on our northern water courses, but the female Mallard wears dusky brown and tawny plumage. Like all ducks, the Mallard has a round bill with saw-tooth edges, webbed feet, and an awkward waddling gait—the latter due to the fact that ducks' feet, which are designed especially for swimming, are placed far back on the body.



HERE is an active little bird (*Oxyechus vociferus*) that helps us by eating harmful insects, such as mosquitoes, fever ticks, and weevils. It is called the Killdeer because it keeps calling "Kill-dee, kill-dee," in a loud shrill key. Killdeer haunt meadows and fields, but are most at home near water. The killdeer's long legs and stout bill tell you that it is a plover. It belongs to the sub-order of shore birds (*Charadrii*). Snipe, Sandpipers, and Curlews, Surf-birds, Stilts, and Avocets are all members of this most interesting group of birds.



OCCASIONALLY this gorgeous bird is seen stalking about in Florida. It is the Scarlet Flamingo (*Phoenicopterus ruber*), and it is the only one of its family (*Phoenicopteridae*) found in this country. Its clumsy-looking bill is really a contrivance for straining its food. The lower part is fitted with holes so that when the bird reaches down and takes a billful of food—certain mollusks—from the mud, the dirt and water run out, leaving its prey behind. For a nest the Flamingo scrapes up a tall mound of mud out of the marsh, with a hole in the top in which to lay its single chalk-white egg.



THIS dignified-looking bird is the great Blue Heron (*Ardea herodias herodias*), and he is an expert fisherman. He stands motionless in the shallow water until he spies a frog or fish coming along, then like a flash his long neck straightens out and the luckless fish is caught in his sword-like bill. His long legs are well adapted to wading among the reeds along shore. Like most fishermen the Blue Heron usually prefers to be alone, but at nesting time he and his mate join a colony of Herons that may include as many as 150 nests. Herons belong to the order *Ciconiiformes*, which also includes the Bitterns, Storks, Ibises, Spoonbills, and Flamingos.



BOB-WHITE'S cheery note is one of the most familiar of bird-calls, for almost every farm has its covey of Quail (*Colinus virginianus*). These birds live in flocks and often sleep tide by tide in a circle on the ground. Bob-White is one of the henlike ground-dwelling birds (*Galliformes*), and he is well fitted for such a life. He can build a nest on the ground so cleverly that it cannot be found, while his brown plumage with its black and white markings blends so well with his surroundings, that when he flattens out in the dry grass or stubble he becomes almost invisible. Pheasants, peacocks, and chickens are other well-known members of the order to which Bob-White belongs.

THE peculiar quality of its call which suggests both deep devotion and great sadness, has given to this bird (*Zenaidura macroura carolinensis*) the name Mourning Dove. Like all pigeons and doves (*Columbiformes*) it has a small head, plump full breasted body and feet equally suited to walking on the ground and perching in trees. When it flies its wings seem to strike over its back, like those of our tame pigeons making a sharp whistling sound at the same time.



THE Vultures, Hawks, Eagles, Falcons and Owls were formerly placed in one order (*Caprimulgiformes*). Because of their structural differences the Owls are now grouped in a separate order (*Strigiformes*), while the Vultures, Hawks, Eagles and Falcons are placed in the order *Falconiformes*. The bird with the widespread wings is the Turkey Vulture (*Cathartes aura septentrionalis*), the most common member of the Vulture family in the United States and a valuable scavenger. Left of the vulture a male and female Sparrow Hawk (*Falco sparverius*) which belong to the Falcon group, sit alert waiting the approach of a mouse, grasshopper, spider or other prey. A white head, neck, and tail, a dusky crown, a yellow bill, and partly feathered tarsus (shanks)—these marks identify the Bald Eagle (*Haliaeetus leucocephalus*) perched in the lower right hand corner. The bird subsists chiefly on fish. In the lower left of the page are a pair of round faced Screech Owls (*Otus asio*), and a Barn Owl (*Tyto alba pratincola*) with its heart shaped face and big tuft.



THE Nighthawk (*Chordeiles minor*), pictured at the left, is widely distributed throughout the United States. In the evening you may hear his nasal peent, peent, as he flies erratically above tall city buildings or in the open country. In spite of its name, this bird is by no means a hawk, but belongs to the order *Caprimulgiformes*. The Whip-poor-will and Chuck-will's-widow also belong to this group. The Nighthawk is insectivorous and catches its prey while on the wing.

THE Hummingbirds and Swifts are grouped in the order *Micropodiformes*. Representatives of this group are the Chimney Swifts and Ruby-throated Hummingbirds seen at the right in the center of the page and in the upper right-hand corner, respectively. While Swifts are distributed throughout the world, Hummingbirds are found only in the Americas. In the United States these gemlike creatures are most abundant on the Pacific coast, the Ruby-throated being the only species that occurs east of the Mississippi.



HERE the Ruby-throated Hummingbirds (*Archilochus colubris*) are gathering dandelion down to line their tiny cuplike nest. Only the male has the brilliant ruby-colored throat from which their name is derived.



ABOVE, a group of Chimney Swifts (*Chatur pelagica*) are hunting insects. Smoky brown plumage, long pointed wings, and a tail ending in spines are the identification marks of this species. These birds live in chimneys, a substitute for their natural homes in hollow trees. They roost and nest in colonies. Their nests, baskets of small twigs glued together with saliva, are gummed to the chimney walls. Most Swifts use saliva in nest construction, and the Swift nests used in soup by the Chinese are made entirely of this substance.



THE Woodpecker's rat-a-tat-tat is the forest rising bell. He clutches the side of a tree, braces himself with his stiff tail, then pounds with his head like a riveter, boring holes so that he can run his long tongue into the bark for grubs. The Northern Flicker (*Colaptes auratus luteus*) is shown in the center. Unlike other members of the Woodpecker tribe (*sub-order Picil*), he often frequents the ground to satisfy his craving for ants. The Downy Woodpecker (*Dryobates pubescens*), at the right, is the smallest and one of the most familiar of the American Woodpeckers, frequenting shade trees, orchards, and woodland. At the left is the Yellow-bellied Sapsucker (*Sphyrapicus varius varius*), which drills many holes in the bark of trees to get at the sap. His tongue is not barbed like those of the other Woodpeckers, but has a little brush on the end with which he laps up the sap.



THE handsome Belted Kingfisher (*Megascops asio*) shown in the upper left hand corner is a skilled fisherman that haunts the shores of wooded streams and ponds. Of the seven American kingfishers he is the only one found north of Texas. Kingfishers belong to the order *Cuculiformes* which also includes the strange Horned Larks, Macaws, Rollers and Bee-eaters. The long slim fellow next to the Kingfisher is the Yellow-bellied Cuckoo (*Coccyzus americanus*) a bird of the woodland. He is yellow lower mandible reddish brown wing feathers and white tipped tail are the marks that distinguish him from the Black-billed Cuckoo which he closely resembles. *Cuculiformes* is the order to which the cuckoos belong. Other birds of this group are the Roadrunners and the Anas.

Most of our feathered friends belong to the order of perching birds (*Passeriformes*) the largest of all bird groups. The distinguishing characteristic of the order as a whole is that the four toes are so arranged as to give unusual strength for grasping branches. The last four birds shown on this page and those on the three following pages all belong to this order.

A GOOD representative of the Tyrant Flycatchers is the Eastern Kingbird (*Tyrannus tyrannus*). This is a trim looking bird with slate gray plumage which is edged with orange colored crest. It is usually seen perched on a fence or low twig darting out into the air every few moments to seize a passing insect.

THE Red-winged Blackbird who haunts the gray plumage in the right center of this page belongs to the family of Icterus. It nests in colonies in the rushes. While the more soberly clad male is on her nest of woven grasses, he sings on the cat tails and reeds of our marshes and sings *O-hu-lee O-hu-lee*.

IN the lower left corner of the page is the Starling (*Sternus vulgaris*), a descendant of the 100 Starlings introduced from Europe in 1890 and 1891. It is clothed in metallic purple or green the feathers of the upper parts all being tipped with cream buff spots. Long pointed wings square tail and yellow bill are other identifying marks. Its habits are similar to those of the English Sparrow, and already it is contesting the latter's supremacy in many eastern cities.

THE western states are the home of the Bullock Oriole (*Icterus bullocki*). Although these birds like especially to nest in fruit trees near a house they can usually be found in the poplars along streams and irrigated fields. The Oriole's nest is a hanging one of horsehair and fibers so cleverly woven that it lasts from year to year and even springs back into shape after being pressed together.





SOMEONE has aptly called the Bobolink (*Dolichonyx oryzivorus*)—another of the *Icteridae*—the “Dr. Jekyll and Mr. Hyde” of birddom. In the spring he comes north in dashing black and white costume, as we see him in the upper left corner, ready to captivate all with his rollicking song as he flits about the meadows searching for insects. But in the fall he dons a dull mottled garb and flies south to the rice fields, where he does great damage to the ripening grain.

QUITE different is the Meadow-lark (*Sturnella magna*), a handsome cheery bird which has the best of habits and destroys many harmful insects. It lives in the fields and builds its nest on the ground under a tuft of grass. It is quickly recognized in flight by the outer white tail feathers that flash in the air. On the ground the Meadow-lark neither hops nor runs; it is one of the few birds that walks. Its three-noted song is one of the sweetest of the bird-calls.

EVERYONE knows that street gamin, the English Sparrow (*Passer domesticus*), shown perched alertly on a stone at the left. Although he was not brought to this country until 1850, he has succeeded in taking almost complete possession of our cities, driving out our native song-birds. He belongs to the family of Weaver Finches (*Ploceidae*). The only other representative of this family in North America is the European Tree Sparrow.

THE Song Sparrow (*Melospiza melodia*) belongs to the largest of the bird families—the *Fringillidae* or Finches. Although this little roadside minstrel has adapted himself to so many varying climates and conditions that he is represented by 23 geographical races, each differing in color and size, we can usually tell him by his breast, which is spotted with black or brownish wedge-shaped streaks and centered by a dark blotch.

ANOTHER member of the Finch family is the Rose-breasted Grosbeak (*Hedymeles ludovicianus*), with his handsome black, white, and rose plumage, one of the loveliest of our summer visitors. He is retiring in habits and stays near his nest in the woods. He is a valuable aid to the farmer in destroying quantities of potato bugs.

THE Black-headed Grosbeak (*Hedymeles melanocephalus*) with his orange-brown breast, is the western cousin of the Rose-breasted Grosbeak. By eating scale insects he helps to save many an orchard crop on the Pacific coast. His happy song can be heard all day long.

THE yellow plumage and sweet song of the Eastern Goldfinch (*Spinus tristis tristis*) have won for him the name “wild canary.” During the early summer he and his mate frolic over the fields and berry patches, and then toward the end of June they gather grass and thistle down for their home in some low bush. In autumn these birds gather in flocks to travel south for the winter.

HERE are some more representative families of the order *Passeriformes*. The Loggerhead Shrike or "Butcher bird" (*Lanius ludovicianus*) the first of the series likes to perch on the top of a small tree, a telegraph pole, or a fence to watch for grasshoppers, snakes and mice. When he has caught his food he impales it on a thorn to hold it while he is tearing it to pieces with his hooked bill.

THE Swallows all have short flat triangular bills, long strong wings and tails that are either notched or forked. Like the Barn Swallow (*Hirundo erythrogastra*) which is shown in the upper right hand corner. Once the Barn Swallows nested in caves but long ago they grew tame and learned to live about barns and sheds thus getting the name "Barn Swallow". They spend most of the summer on the wing catching insects and eating them as they fly.

INSECTS on the foliage of trees and shrubs furnish the food for the active little Red-eyed Vireo (*Vireo olivaceus*) which is shown just underneath the Barn Swallow. He is a persistent singer and keeps repeating his song from morning until night. Like others of the vireo family—whose name is Latin for "I am green"—he builds a beautiful hanging nest of finely woven grasses and fibers in the fork of a tree.

THE trills and melodious of the Mocking bird (*Mimus polyglottos*) make the sweetest of serenades. Nothing is too difficult for this southern songster to attempt a dog's bark, bird calls and even the sounds of instruments are included in his repertoire and he also has a love song all his own. Here the most conspicuous singer of the mimicking birds (*Mimidae*) among whom are included also the Catbird and Brown Thrasher.

SCATTERED flocks of Pipits (*Anthus spinoletta rubescens*) one of which appears below the Vireo, forage in our pastures and fields on their way south from the summer haunts in Canada. They like the open country and prefer wet fields and bogs. They are ground birds and run about looking for worms and insects. When frightened they fly into the air with great leaps, calling pipit pipit.

THIS mate of a bird is the busy little House Wren (*Troglodytes aedon*). Jenny Wren knows that she is an excellent housewife and it is her talent with becoming pride. She will build her nest in any old can or basket that happens to be convenient, if it has an entrance small enough to keep other birds out. Her long curved bill, short wings and pert tail are characteristic of the wren family whose name *Troglodytidae* means cave dwellers.

THE Brown Creeper (*Certhia familiaris americana*)—shown in the lower right hand corner—is a quiet sort of a bird and though he and his cousins the Nuthatches are classed as woodpeckers (*Caprimulgidae*) because they have vocal organs they are not real singers. They live on little insects which they find as they scramble incessantly over the trunks and branches of trees.



THE White-breasted Nuthatch (*Sitta carolinensis carolinensis*), on the left, is supposed to get its name from the habit of wedging beechnuts and other nuts in crevices of the bark and breaking them with its beak. It clings to the bark entirely with its claws, for its tail is too short and round to be used as a brace like the Woodpecker's.

A WINTER snow storm is an opportunity for a romp for the cheery little Chickadee (to the right). Like the Nuthatch, the Chickadee (*Parus atricapillus*) does not mind in the least being upside down as he goes poking over trees for insects. He dresses in plain dull colors, as do the other members of the Titmouse family.

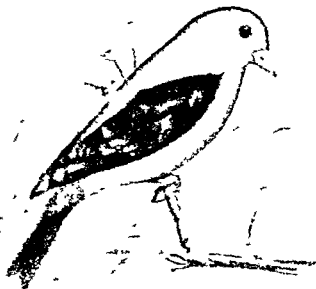
THE Scarlet Tanager (*Piranga erythromelas*) at the left is a gay fellow who flashes through our woods in summer with such brilliance as to merit the name "Fire-bird" sometimes given him. His mate, however, is a modest creature in olive green, but resembling her husband in the blackness of her wings. The song resembles that of the robin. The Tanagers are a distinctively American family. They range from Canada to Argentina.

ROBIN Redbreast (*Turdus migratorius*) needs no introduction, for he is the most familiar of our Thrushes. In the spring the children watch for him because he tells them that the winter is over. He is such an affectionate fellow and seems to enjoy human society so much that we gladly forgive him for the cherries and other small fruits that he eats as a dessert to his favorite food, worms.

ITS fondness for myrtle shrubs gives the bird shown beneath the Robin the name Myrtle Warbler (*Dendroica coronata*). It lives in the woods and hedges, where it hunts among the leaves for insects which are its food. The bright yellow patch above its tail distinguishes it from the other Wood Warblers. They all have beautiful plumage. The Myrtle sings a simple, caroling song, but most of the warblers are insignificant musicians.

THE Horned Lark (*Otocoris alpestris alpestris*)—lower left-hand corner—along with its many subspecies is the only member of the true lark family (*Alaudidae*) native to America. He loves the plains and deserts and his nest is built on the ground in pastures, often before the snow disappears. Like the rest of his family he is an excellent musician, and his jubilant song tells us what it means to be as "happy as a lark."

THE tiny sprite in the right-hand corner is the Ruby-crowned Kinglet (*Corthylio calendula*), who is just as merry a winter bird as his playmate the Chickadee. He is very proud of his bright crest, which he can uncover when he wants to show it off. Indeed the kinglets (*Sylviidae*) receive their name from this patch of bright color on the crown of their heads, which brightens up their otherwise dull plumage of olive, brown, and black. They eat the seeds of weeds and poison ivy, as well as scale insects and other pests.



How to

Attract and Study Birds

IF WE WANT to attract birds to our homes, we must first make sure that they have a supply of fresh water. Birds need water not only for drinking and bathing but also to furnish mud for nests. And if they have plenty of water close at hand, they will apparently eat fewer of our cherries and other fruits. In the absence of a brook or pond, a bird bath will go far to supply the lack. This need be nothing more than a pan or a shallow cement pool on the ground. Care should be taken that the bath is not too close to shrubbery, in which a cat may lurk.

Winter is the best time for feeding birds for it is then that insects are hardest to find. Feeding is particularly important after ice storms, but if feeding is once begun it should be continued until spring. Birds should have suet in addition to mixed seeds, such as cracked corn, hemp, millet, and sunflower seeds. To keep squirrels and jays from carrying suet off in large pieces it may be protected by coarse wire or heavy strong netting or it may be placed in split coconuts hung from branches.

Feeding Stations and Devices

A tray outside the window, sheltered from rain and snow by a glass roof, is an attractive feeding station.

"Weathercock" food stations, which turn on a pole and thus always face away from the wind, are also good. Trays hung by wires completely outwit squirrels and it is easy to devise automatic food hoppers in the form of inverted bottles filled with seed. A roofed 'trolley tray,' hung on pulleys from a wire run-

A good birdhouse attracts and protects nesting birds and lets you study the young ones as they grow up.

ning from a window to a tree or a post will enable the observer to pull his guests a little closer each day. Thus he may coax under his eye an extraordinary variety of winter birds some of which might be too shy to fly up directly. The feeding devices shown in the accompanying illustrations can be made at home by anyone handy with tools.

Spring and summer feeding is less profitable because at those seasons most birds including the seed eaters, turn to the natural supply of insects and fruits. However it is possible to lure hummingbirds to one's porch all summer by hanging up small bottles filled with sugared water.

Nest Building and Birdhouses

Material for nest building presents a temptation that birds cannot resist. It is astonishing to note how many kinds will come in the spring to gather cotton straw, horsehair, wool, moss feathers, or colored yarns laid out for their choice. One experimenter succeeded in persuading several pairs of Baltimore Orioles to weave their hanging baskets almost entirely of brilliant-hued knitting yarns.

Birdhouses may be easily built or they may be bought ready made. An old wagon wheel on a pole will support an osprey's nest, and a single bracket will give robins and phoebes a place to build. Houses with walls range from simple structures in the form of gourds, hollowed logs, small kegs, and



THE RIGHT WAY TO HOLD A BIRD



To band a bird, grasp it like this and then press the thumb gently down over the wing to stop its fluttering. Notice that the brown thrasher in this picture has already been banded on its right leg.

boxes to the elaborate "apartment houses" intended only for purple martins. Among the birds in various parts of the United States that have been known to nest in birdhouses or sheds of one sort or another are wood ducks, goldeneyes, hooded mergansers, barn owls, screech owls, saw-whet owls, sparrow hawks, six or more species of woodpeckers, two of flycatchers, three of swallows, six of titmice, two of nuthatches, several kinds of wrens and bluebirds, robins, one warbler, and two or more species of finches. The eastern bluebird is especially worth encouraging, because it has perhaps suffered more from the competition of the European starling than any other American hole-nesting bird.

Plans for simple birdhouses are shown on the next page. They need not be works of art, but they should meet definite specifications as to dimensions, size and position of entrance, ventilation, drainage, and the place, height, and date at which they are put up.

More detailed information may be obtained from the National Association of Audubon Societies, 1006 Fifth Avenue, New York City, or found in "Farmers Bulletin" No. 1456, entitled "Homes for Birds", sold for five cents by the Superintendent of Documents, Washington, D. C.

Roger T. Peterson's list of things to avoid will also be helpful in building successful birdhouses:

1. Do not make the opening too large.
2. Do not place the hole toward the bottom of the box—except in the case of martin houses. Most birds like to be out of sight while incubating the eggs—so the hole should be well above the center.
3. Do not make two-family or four-family "apartment houses," except for martins. Most songbirds have the "territory" habit highly developed and will not tolerate another family under the same roof.
4. Do not use tin cans. The sun is likely to heat the metal and bake the fledglings.
5. Do not set up too many boxes in a limited area. Except for martins and tree swallows, the normal number of boxes should be not more than three or four to the acre.
6. Do not leave the old nests in the boxes. After each brood, take the box down and clean it.
7. Do not build a birdhouse "for birds"; build it for wrens, for bluebirds, or for some other definite species, keeping in mind the requirements of the desired tenant.

Trees, Shrubs, and Vines

The most satisfactory way of attracting birds of every kind is to "cultivate the range" for their benefit. This means to protect and extend a natural growth of vegetation that furnishes food and shelter. The artificial breeding of game birds is expensive; food dished out by human hands is really useful only as long as the supply never fails. But wonders can be worked by encouraging suitable food plants, keeping wide hedges between tilled fields, and leaving a few dead trunks in the wood lot and a few tangles of undisturbed brush and thicket. A bed of sunflowers left to ripen will keep many birds busy for months. In several parts of the country it has been found that if as little as 2 per cent of the growing grain is left unharvested, this reserve will carry half a dozen coveys of quail through a hard winter.

A fair proportion of trees permitted to grow to full maturity greatly increases the number of birds. Old

woodland, with normal undergrowth and forest-fry plants, is likely to have twice as many kinds of birds and five times as many resident families as young woods of the same sort in which the undergrowth has been cut, burned, or grazed out. The living space of birds is, in other words, to be measured by cubic volume rather than by square area. The British Isles, for instance, have not nearly so many species of birds as occur in most parts of North America. Yet perhaps nowhere else in the Temperate Zone do birds seem to abound as in England. This is due largely to the fact that the English people have wisely preserved so many of their vast and ancient trees.

For planting in places where natural vegetation is lacking, the country is filled with trees, shrubs, and flowers that offer special advantages in the way of shelter, nesting places, and food. Food is not limited to fruits and seeds, but includes also the wide variety of insects associated with certain kinds of plants, such as the gray birch. At least 80 different species of birds are known to eat the fruit of the thicket thorn, and nearly as many patronize some of the mulberries. Native plants are usually to be preferred to foreign species.

Following are the names of a few plants that are regarded as "good" or "excellent" both as nesting sites and as sources of food, together with an indication of the season in which they help the birds' larder. A large proportion of them will thrive in most parts of the United States.

Trees: Flowering dogwood (*Cornus florida*)—autumn; thickset thorn (*Crataegus coccinea*)—autumn and winter; Washington hawthorn (*C. cordata*)—winter; cockspur thorn (*C. crusgalli*)—autumn and winter; red cedar (*Juniperus virginiana*)—winter; crab apples (several species of the genus *Malus*)—winter; white and red mulberries (*Morus alba* and *M. rubra*)—summer; Norway spruce (*Picea excelsa*)—winter; white pine (*Pinus strobus*)—winter.

Shrubs: Alternate-leaved dogwood (*Cornus alternifolia*)—autumn; cornelian cherry (*C. Mas*)—autumn; autumn elaeagnus (*Elaeagnus umbellata*)—winter; ground juniper (*Juniperus communis*)—autumn and winter; privet (*Ligustrum vulgare*)—winter; Tartarian honeysuckle (*Lonicera tatarica*)—early summer; bayberry (*Myrica carolinensis*)—autumn and winter; common buckthorn (*Rhamnus cathartica*)—summer and autumn; fragrant sumach (*Rhus canadensis*)—winter; common elder (*Sambucus canadensis*)—autumn; scarlet elder (*S. pubens*)—summer; red-berried elder (*S. racemosa*)—summer and early autumn; arrow-wood (*Viburnum dentatum*)—early autumn; nannyberry (*V. lentago*)—winter; black haw (*V. prunifolium*)—autumn and winter.

Vines: Virginia creeper (*Pedera quinquefolia*)—late autumn and winter; common matrimony-vine (*Lycium hali-folium*)—autumn. (See Gardens and Gardening)

A detailed list of a much larger number of species in relation to birds, as well as to ornamental value and ease and conditions of cultivation, can be purchased for five cents (Circular No. 19) from the National Association of Audubon Societies, 1006 Fifth Ave., New York City.

The Delightful Hobby of Bird Study

The enjoyment and appreciation of birds are sufficient reasons for learning to name them and for encouraging their presence. As Dr. Frank M. Chapman has said, "Birds are nature's most eloquent expression of beauty, joy, and freedom." Bird photography is

TWO GOOD BIRD HOUSES—EASY TO MAKE

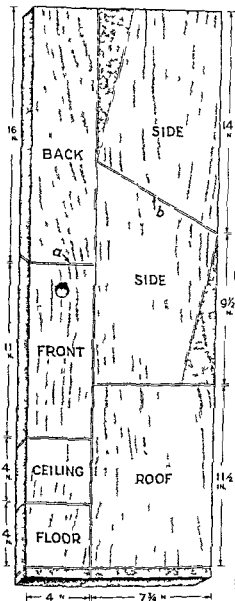


Fig 1

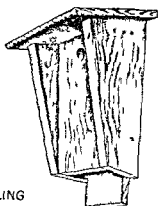


Fig 3

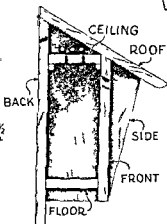


Fig 2

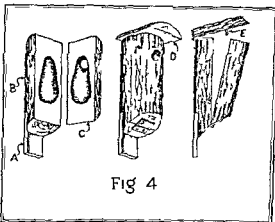


Fig 4

The first of these is designed for wrens. Notice in Fig 1 that all the parts of this house can be cut out of a single 3 foot board of standard width and thickness (1 1/2 in. by 1 1/2 in.). The drawings make the design clear. The saw-cut marked 'a' in Fig 1 must be made at an angle of about 60 degrees. The two Sides are identical and the difference between the long edge (14 in.) and the short edge (9 1/4 in.) will make the angle of the saw-cut marked 'a' most exactly 60 degrees. Figs 2 and 3 show how the parts of the house are assembled. The distance between Ceiling and Floor should be about 8 1/2 in. The Ceiling should not be added but should rest on casters so that when the hinged Roof is raised

the Ceiling can be removed for cleaning out the house. The entrance hole for the wrens must not be more than 4 1/2 in. in diameter to prevent larger birds from trespassing. It should slope upward so rain will not run in. The ventilating holes around the top and through the Ceiling will help to keep the house cool in hot weather. Painting the house inside and out will make it last longer. Fig 4 shows another type of house for wrens, bluebirds or flickers easily made by splitting and bolting out a single log. The board 'A' is used to fasten the house to a post or limb. 'B' and 'C' are bioged at the bottom and the roof 'D' holds the two together at the top by means of the short pin 'E'.

delightful and rewarding hobby, though it requires ingenuity. To get good bird pictures, one must generally use "blinds," such as a draped beach umbrella, or a screen of vegetation, or one may use long cable releases or strings for snapping the camera shutter from a distance. Though relatively few persons can take up bird study as a serious avocation, those who are keenly interested can find abundant opportunity to add to the sum of knowledge.

The time has passed in which collecting skins, eggs, or nests can accomplish anything of importance except in connection with special and unusual problems. North American birds are nearly all well known as to description and range, and adequate collections are preserved in museums. It is the living bird that now offers the most helpful opportunity for real research. The motto of the *Audubon Magazine* well states "A bird in the bush is worth two in the hand"

Exactness and objectiveness in making notes are more important than "fine writing." The great poets and naturalists of our own and earlier generations have given us a rich record of the impressions made by birds upon sensitive human beings; but scientific understanding of the basis of bird behavior has lagged behind. It is easy, but not very helpful, to "humanize" birds. They are highly instinctive creatures, with marvelous sense organs and bodily processes that proceed at a high rate. Their pulse and respiration are more rapid than ours and their temperature considerably higher. On the other hand, their brains have none of the folded surface and very little of the "gray matter" that characterize the brain of a man or even of a dog. The mental processes of birds, indeed, are in some respects more closely akin to those of insects than of mammals.

How do birds respond in recognizing their own kind or other species, and in their courtship? What is the

true meaning of their singing? Why their exclusiveness and jealousy regarding the private "territory" of breeding pairs? How does the internal "clockwork" of their bodies make them migrate at one season, build nests of a constant type at another, sit on eggs later, rear and then "heartlessly" abandon or drive away their fledglings? When we study such problems carefully, we soon realize that we are entering a field in which only precise, and, if possible, statistical information is of service.

Bird Banding

A development of recent years that has added greatly to exact knowledge of birds is the well-organized custom of bird banding. To undertake this, one must first be able to identify one's captives with certainty and be well acquainted with right and wrong methods, learned from the experience of bird banders in the United States and Europe. A permit to trap and band must be obtained from the Fish and Wildlife Service at Washington. This service also supplies numbered aluminum leg bands and full instructions regarding cage traps, other equipment, and technique.

Hundreds of thousands of birds are now banded annually in the United States. A fair proportion of this work is undertaken or shared in by young people. The returns are surprisingly high, and a great deal has been learned about the routes and length of migration, the "homing" propensities of birds, the age to which they live, and their relationship to individual mates. Banding and trapping enable an observer to *know*, instead of merely to guess, that the phoebe nesting on his porch was there last year. Moreover, many birds, such as the house wren, will stand almost any amount of proper handling, and so it is possible by catching them in their birdhouses to band all the residents of such species in an entire district and follow their complicated family relationships from brood to brood and year to year.

A HOME-MADE FOOD HOPPER



A handful of sunflower seeds, ground raw peanuts, hemp, and millet will save many birds when snow and ice cover up natural foods.

Protecting and Conserving Our Birds

INTEREST in birds and their conservation no longer requires any justification. It is hardly necessary even to point out the economic importance of birds because of the insects they eat. Indeed, this particular value has been overemphasized. Many more kinds of insects are beneficial than are harmful, and birds seldom discriminate. But insects multiply at an incredible rate, and even "useful" forms become a pest when they grow overabundant. The essential place of birds in nature's long chain of the eaters and the eaten is to do their part in keeping the delicate balance. The only birds that do not fit well in the balance

are the foreign introductions, like English sparrows and starlings; but this is true also of other forms of life that have been brought from abroad, such as house cats, carp, the Japanese beetle, the gypsy moth, many European weeds, and Old World organisms that cause plant diseases.

When North America was a wilderness, native animal life of every sort was amazingly abundant. It was controlled directly by climate rather than by changes brought about by man in cutting down forests and adapting the land to crops, to pasture for cattle, and to sites for villages and cities.

Brooks and larger streams ran with clear water in which trout, food plants, and countless other forms of life could thrive. There was no pollution from sewage or factories. The watersheds were protected by dense growths of grass, shrubs, trees, and forest litter. The "water table" in the ground was held at a high level by dams of the beaver, which lived nearly everywhere from Mexico to the edge of the Arctic. Thus the clean streams were constantly checked on their way toward the sea, and water was made to yield its fullest use to enrich the vegetation upon which all animal life depends.

It was only after man had recklessly felled the trees on the steep hillsides and had plowed the land in a way permitting rainfall to form gulches and wash away the topsoil that many rivers turned brown or red with "the lifeblood of the land." The amount of plant food in this soil now wastefully carried to the ocean by rivers in the United States is reckoned to be 20 times as much as the amount taken from the soil by all farm crops.

Predatory Animals and the Balance of Nature

It should be noted that in primitive times the predatory animals—those that eat others, such as wolves, mountain lions, lynxes, weasels, eagles, hawks, and owls—existed in far greater number than in our own time. Yet, in spite of this, the plant eaters, the creatures we call game, the songbirds, and all other harmless and familiar animals flourished. Probably no wild bird or beast under natural conditions has ever exterminated another species or even seriously reduced its numbers. The flesh eater varies its diet; it kills off the weak and the sick in greater proportion than the strong, also, its food usually includes other enemies of the species upon which it relies for its living.

Seldom, indeed, can man determine which wild animals are beneficial and which are destructive or undesirable, because the chains of relationship in nature are mostly complex and hidden from our view (see *Ecology*). An example may illustrate this. In Georgia, where quail are fostered as game birds, it was formerly the custom of sportsmen to shoot marsh hawks at every opportunity because these hawks sometimes killed quail. But the slaughter of marsh hawks seemed to accomplish nothing toward in-

creasing the numbers of quail. Finally it was learned from the examination of stomach contents that the marsh hawk feeds mainly upon the cotton rat, a rodent highly destructive to the eggs of quail and other

ground nesting birds. By being a much greater foe of cotton rats than of quail the marsh hawk proves actually to be a friend of the quail. The killing of this bird of prey has now largely ceased in Georgia, and both marsh hawks and quail are growing more numerous side by side.

Again, it is well known that anglers are likely to have a strong prejudice against fish-eating birds such as pelicans, cormorants, kingfishers, herons, terns, ospreys, and certain ducks. Careful studies show, however, that these birds have little to do with the decline in fishing, because their prey is made up largely of non-game fishes, including kinds that eat the spawn or young fry of others.

Many similar examples might be given to prove that predatory animals are an essential part of what is called "balanced nature" and that most of the antagonism toward them is due to lack of sound knowledge.

Indians and the Balance of Nature

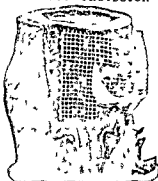
The Indians too, who occupied this continent before white men arrived, were merely a part of the great balance of nature and did not seriously affect it, as the white man did later. Most of the Indians were flesh eaters, who ate game of many kinds. But their population was relatively small, their weapons

not unduly deadly, and their motive was to gain necessary food and clothing rather than to satisfy a love of sport. The red men performed no engineering or agricultural feats to alter the face of nature on a grand scale. Moreover, they observed the principles of conservation better than their white successors, because whenever game was temporarily reduced by excessive killing or by natural causes, there was room to change the hunting grounds. They lived in the midst of teeming wild life that might have continued indefinitely.

Misuse of Resources

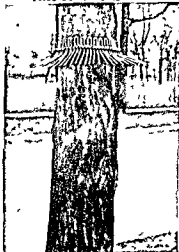
Now no one would wish the whole course of history changed, or the civilization that has followed the Indians to be wiped out, for the sake of restoring the primitive state of nature. Nevertheless, if that civilization is to go forward,

WIRE FOOD PROTECTOR



Wire screening fastened in this way serves to hold either food or nesting material. The cage shown here contains suet. It is protected from crows and squirrels, but the little brown creeper has no trouble in getting at it.

THIS STOPS THE CATS



With a simple bent wire device like this around a tree in which there are nests, your bird neighbors are safe from cats and other climbing enemies.

we shall have to take account of the widespread and unnecessary destruction resulting from ignorance, heedlessness, or selfishness. It is safe to say that North America in the last three centuries has suffered more from misuse of natural resources than any other continent.

We must realize that it is not possible to save our birds alone, or the forests, the wild flowers, the life of river and sea, the game mammals, the fur bearers, or anything else alone, because nature is a great unit. Every evil practise with regard to one aspect spreads out through the web of life and affects many others. The goal must be to restore and maintain the closest approach to balanced nature that is consistent with the requirements of a large human population.

The "Inexhaustible" Game Supply of Early Days

Writings of the early European colonists in North America are filled with expressions of wonder at the wealth of life. This applied to the variety of trees in the forest (eight times as many as in Europe), to the fruit and flowers, the squirrels and deer, the fish, the lobsters and oysters, and perhaps most of all to the birds. It was natural that every toothsome wild fowl should have been considered a God-given resource, especially by Englishmen who came from a country where a man might be imprisoned for taking a pheasant's egg, or hanged for killing the deer of a

rapid increase, and that the change men were making in the character of the country was depriving most birds and other wild animals of food and cover at the same time that they were being killed by every means and at every season.

Birds That Have Vanished or Dwindled

The wild turkey, which lived only in North America, was one of the first birds to become greatly reduced. The reason is simple, for a visitor to New Jersey in the year 1648 mentions a flock of 500 turkeys "got by nets" at one time! This wonderful fowl has fortunately not altogether disappeared, and is today even gaining in certain states. It is important to recall, however, that the settlers in New England and the Middle Atlantic states quickly wiped out the wild turkeys along the Atlantic seaboard. Domestic turkeys, the descendants of birds that had been carried from America to Europe by Spaniards, were brought back across the Atlantic to New England and New York at about the time when the last local wild turkeys disappeared. It is worth noting here that the Spanish colonists were much more clever than the British in domesticating and cultivating all sorts of useful animals and plants of the New World.

Other splendid birds that have fared even worse than the turkey are the Carolina parakeet, the heath hen, or eastern prairie chicken, and the passenger pigeon. These were extremely abundant, but the last

survivor of each has perished since the beginning of the present century.

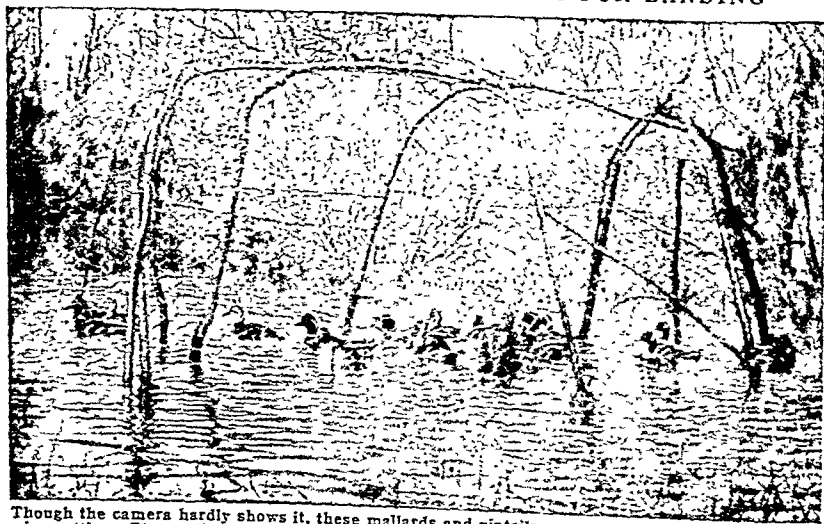
The passenger pigeon used to travel in flocks that darkened the sky and took hours or days to pass a given point. It fed especially upon the nuts of the beech and the acorns of the white oak, and the old-time groves of these immense trees also furnished its nesting places. Passenger pigeons became such "common" food that servants and even slaves objected to eating them. Men laughed at the idea that the wild pigeons might ever become "scarce." Yet Audubon, the great naturalist, appears to have foreseen that the endless slaughter,

combined with the cutting down of the oak forests, could not fail to be disastrous. At any rate, the last passenger pigeon died in the zoo at Cincinnati in 1914. (See also Pigeons and Doves.)

Can These Birds Be Saved?

Among remarkable North American birds that have dwindled to great rarity because of less direct and

HEART-SHAPED TRAP CATCHES DUCKS FOR BANDING



Though the camera hardly shows it, these mallards and pintails are securely trapped in a cage of wire netting. The netting covers the framework of poles and is arranged on one side to form a long funnel leading inward and ending in a small opening. Once the birds have entered through this opening, they rarely find their way out again.

landed proprietor. It was a welcome change to feel that wild turkeys, heath hens, partridges, pigeons, ducks, geese, swans, cranes, rails, and many smaller birds might be taken in this New World, freely and without limit. Game was regarded as "inexhaustible."

The sad error lay in the fact that for the first time in America mankind was undergoing an amazingly

THE TRUMPETER SWAN ONE OF THE RAREST OF AMERICAN BIRDS



This beautiful trumpeter swan is nesting on the Red Rock Lakes Migratory Waterfowl Refuge in Montana and near by Yellowstone National Park. These birds once were threatened with extinction but under government protection their numbers have increased in recent years beyond the danger point.

possibly less wanton persecution are the ivory billed woodpecker the California condor the whooping crane and the trumpeter swan. The first of these is the king of woodpeckers larger than a crow black and white and crested with scarlet armed with a white beak and equipped with the most remarkable adaptations known in the woodpecker family. The enormous chips it hews from trees infested with wood boring insects have been likened to the work of a corps of axmen. Its existence depends upon stands of gigantic cypresses and similar trees and unlike many birds it does not tolerate the close presence of man. Following the clean sweep of the southern forests by lumbermen it has all but vanished. This illustrates once again that we cannot abuse one aspect of life without at the same time working unexpected damage upon others.

The whooping crane and the trumpeter swan have likewise suffered in part because of damage to their ranges. The case of the California condor largest of North American birds is less clear. The condor is a harmless carrion eater of limited distribution and its disappearance has to some extent been due to poisoned carcasses set for bears and coyotes. The thoughtless man with a rifle ever ready to prove his marksmanship on a living target probably is also to blame. Efforts are now being made to save the few remaining condors.

Certain marine birds were exterminated at an early date for the reason that their breeding grounds were limited to small localities. Thus the great auk a flightless swimmer bearing some resemblance to the penguin nested only on a few northerly islets in the North Atlantic. About 1844 the last bird disappeared forever because of the constant raids made by sailors during the egg laying season. The Labrador duck died out somewhat later. It appears to be always true that when an animal population becomes reduced below a wide margin of safety the species is sure to go.

Conserving Our Waterfowl

In general the North American waterfowl such as wild ducks of many kinds for a long while held their own better than the birds thus far named. This was because they came chiefly as autumn migrants from nesting grounds in the extensive marshy wilderness of the Northwest. They could thus for a time withstand even the heavy toll of market-hunting in the course of which a single professional gunner might bag several thousand ducks in one season. They were at least able to rear large broods after they had returned to their summer homes and thus restore a good proportion of the annual loss.

But matters took a rapid turn for the worse with the sowing of the Northwestern states and the Canadian Prairie Provinces to grain, the steady growth

of population and consequently of hunters, the modernization of arms and ammunition, the extension of roads, and the coming of motor cars. Only shortening of the shooting season, lowering the bag limit, outlawing the sale of game, and the establishment of refuges or sanctuaries have saved these game birds from final destruction. Their condition today is by no means as secure as we must still make it if we hope to preserve them for the enjoyment of future generations.

The effect of breechloaders and smokeless powder was especially marked upon the shore birds, that is, the many species of snipes and plovers. These were shot with old-fashioned firearms throughout most of the historic period, but after rapid-fire shotguns came into use, they were suddenly almost wiped out of existence. One of them, the Eskimo curlew, is probably extinct, and several others are in grave danger. The permanent protection now given in the United States and Canada to all but two kinds, the woodcock and Wilson's snipe, has shown encouraging results.

It is not improper to regard game as a "crop" and shooting as a reasonable recreation. The point to remember is that the continuance of game, rather than the choice of those who like to shoot, must always be the basis of legal control. Since some birds, such as many ducks and members of the grouse family, are widely distributed and relatively resourceful, they can support well-regulated shooting both now and in the future. Others, such as most shore birds, can probably never stand any shooting at all under modern conditions.

The Dangers of Artificial Drainage

Ducks and innumerable other marsh-living birds all over the United States have suffered severely from the artificial drainage of wet or moist areas. The public attitude in this matter seems to be almost peculiar to America, because in the Old World ponds and marshes are traditionally considered places of beauty, worthy of being saved for their reserves of wild flowers, reeds and cat-tails, fish, birds, and other forms of life that can thrive nowhere else. Among us, most of the natural ponds in thickly settled regions have been filled with ashes and defunct motor cars, while hundreds of millions of dollars have been spent in draining the marshy homes of waterfowl, without any equivalent success in making new tracts available for agriculture. The water table has been lowered, to the detriment of the surrounding country; alkaline wastes have remained on the sites, as at Malheur and Klamath lakes in Oregon and northern California; or the humus has dried and burned down to the limestone, as over much of the Florida Everglades.

Drainage is sometimes justifiable, or even necessary, but when it results from political activity, and is carried out by engineers without benefit of biological advice, its effects are almost certain to be unfortunate. A large part of the so-called mosquito drainage has failed of its purpose, while at the same

time a desirable balance of life on the marshes has been disastrously upset.

Hunting Plumes and Trapping Songbirds

Certain other practices that endangered many kinds of birds have been banned forever. One of these is "plume hunting" for feathers to use on women's hats. Fifty or sixty years ago this barbarous custom had a wide vogue and was responsible for an appalling slaughter of egrets and other herons, gulls, grebes, and many songbirds. W. E. D. Scott writes in his 'Story of a Bird Lover' that when he worked in a New York taxidermist's shop in 1874, from 350 to 400 songbirds were purchased *daily* from local gunners. The long and finally triumphant fight against millinery traffic in birds was a turning point in American wildlife protection. Only in recent years have some of the most severely persecuted species begun to regain their numbers and reoccupy their old ranges.

Another custom that seems strange to us today was the commerce in trapping songbirds. Few can now appreciate the effect of this on the bird life of large areas. About 1880, when caged mocking-birds, cardinals, and scores of other species were in demand, one of many bird dealers in New York City received and sold 800 male bobolinks. Small wonder that this cheerful songster no longer inhabits the Long Island fields where it once abounded!

Beginnings of Legal Protection

White men had been multiplying a long while in the American colonies before there was any broad attempt to stop unlimited killing of birds or other game. The colonists were a free people, accustomed to dealing as they pleased with the "inexhaustible" riches of the new country, and they resented interference as bitterly as many gunners of a later day objected to the ending of the spring shooting season for ducks.

The first legal control of any kind was adopted in the Dutch colony of New Netherlands in 1629. In 1677 Connecticut, and in 1694 Massachusetts, followed with laws establishing a closed season for certain game. North Carolina, the first Southern colony to act, began the partial protection of game in 1733. In 1818 Massachusetts made it unlawful to kill robins between March 1 and July 4!

By the end of the Colonial period, 12 of the original colonies had at least a few game laws. However, it was not until 1878—a mere two generations ago—that Iowa became the first state to fix a bag limit by restricting the number of grouse and prairie chickens that might be killed by a single hunter during one day and one season. The Latin American colonists were more advanced than our own ancestors, for sensible game statutes, reading not unlike those with which we are familiar today, were decreed at Lima, Peru, as early as the year 1555.

Rise of the Conservation Movement

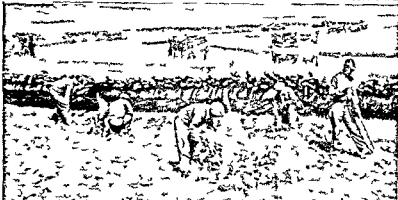
Nevertheless, in course of time North Americans took the lead (see Conservation). It was through the liberty-loving people of our own youthful republic, as Dr. T. Gilbert Pearson has written . . . "that

there was to take form a new policy in Anglo-Saxon jurisprudence with reference to man's legal relation to wild life. It was the legislatures that in time declared that the living wild game of the state belongs to the whole people of the state with the legislature holding it in trust and that no wild bird or other animal belongs to an individual man until

society which cooperate with other private agencies and with the state and federal governments (see Audubon).

The United States Biological Survey came into being in 1905 growing out of an office of economic ornithology in the Department of Agriculture. In 1940 it was combined with the Bureau of Fisheries as

RESTORING A NESTING AND FEEDING AREA FOR WATERFOWL



By re-creating marshes such as this one in the Upper Souris Refuge, N. D., waterfowl are persuaded to return to their old homes. Workmen are building a wave break and nesting is aided.

it has first been reduced to possession. Furthermore it was the courts they established that upheld the validity of these statutes. And based upon these principles there was founded the unique and daring American experiment of attempting to preserve a nation's game supply and at the same time provide a reasonable amount for limitless hunters.

Probably 90 per cent of our bird protective laws have been enacted within the past 50 years. Yet before the middle of the 19th century enough public sentiment had developed so that considerable support was working toward needed legislation. By 1883 when the American Ornithologists Union was founded 19 of the 39 states then existing afforded protection of some sort to non-game birds. The Ornithologists Union was active in stimulating laws for the protection of birds not used for food but for many years law-enforcement officers were woefully few.

Audubon Societies and the Biological Survey

The first Audubon Society was formed in New York in 1896, the beginning of a movement that soon became influential. In 1905 the National Audubon Society was formed. This association has since been active on every front. It has conducted educational campaigns and legislative battles and has enrolled thousands of men and women and millions of school children. It publishes the *Audubon Magazine* (formerly *Bird Lore*) and much other literature relating to birds, maintains sanctuaries for oppressed species or as symbols of what can be accomplished and operates summer camps in which teachers and other leaders are trained. Through these and other activities the National Audubon Society has set a high standard for

the Biological Survey many of which are distributed free or at trifling cost have been a great factor in educating the American public about the value of birds.

Other Protective Agencies

Other organizations concerned with bird protection or with sound policies on natural resources which include birds are too numerous to list. Some of the national groups are the General Wildlife Federation, the American Nature Association, and the Isaac Walton League of America. Nor can we neglect to mention the powerful activities of the national federations of women's clubs and garden clubs and the broad and fruitful interest in conservation that has grown up among such young peoples organizations as the Boy Scouts, the Girl Scouts, the Campfire Girls, and the 4-H Clubs.

Every state in the Union now has a department devoted to the conservation of wild life. In the main the growth of good laws has been gradual as indicated above but there have been periods of monumental advances such as the passage by Congress of the Migratory Bird Treaty Act on July 3, 1918 and the establishment of extensive national bird refuges which began in 1924.

The treaty referred to was a formal agreement between the United States and Great Britain for the protection of migratory birds in the United States and Canada. At the same time the Model Law generally known as the Audubon Law which was already in force in most states was followed in the naming of about 250 species and subspecies of birds as game. More than half of these however including nearly all

the shore birds, were put under complete protection for a term of years which was later extended. In 1936 a similar treaty, though with less comprehensive provisions, was negotiated with Mexico. The Migratory Bird Conservation Act of Feb. 18, 1929, provides for the acquisition of lands suitable as feeding, resting, and breeding grounds for migratory birds. The Tariff Act of 1930 forbids the importation of birds and bird products protected by foreign countries.

Refuges and Sanctuaries

It has long been recognized that refuges and sanctuaries, in which no shooting is permitted at any time, are needed as resting places for game birds. Moreover, with the constantly increasing use of the land for lumbering, grazing, agriculture, or settlement, it becomes a pressing necessity to set aside portions as "wilderness areas" in which all wild life may work out its natural balance under the closest approach to undisturbed conditions. Some sanctuaries are therefore intended for the protection of particular species, others for the welfare of many.

The first United States Government bird reservation was that created at Pelican Island, Fla., by executive order of President Theodore Roosevelt, on March 14, 1903. This great leader in conservation signed 50 later orders to accomplish similar purposes, and every president since his time has added to the list. Other federal reservations have been set aside by Congress, and the movement has grown rapidly during the last few years. The Fish and Wildlife Service now administers almost 300 refuges for birds and 13 big-game reserves on which birds also are protected. These have a total area of nearly 18 million acres.

Most of the bird refuges are west of the Mississippi, although the Gulf Coast and the Atlantic Coast from New Jersey southward are well covered. There are refuges in nearly every Western state. North Dakota alone has about 75, some of which have been leased at a nominal rate by the government instead of being purchased. There are federal refuges also in Alaska, Hawaii, and Puerto Rico.

The sanctuary policy of the National Audubon Society concentrates on the protection of threatened species of birds rather than on maintaining areas for other kinds. The largest sanctuary owned by the association is the Rainey Sanctuary on the coastal marshes of Louisiana, where thousands of ducks and geese pass the winter. Colonies of breeding herons, egrets, spoonbills, and pelicans, as well as other birds with too many human enemies, are guarded from Florida and Texas to New England. Some of the smaller sites change from year to year, as the birds shift their headquarters, but the number of sanctuaries administered is usually about 45.

The Audubon Society also maintains the Roosevelt Sanctuary, at Oyster Bay, Long Island. In this sanctuary of 13 acres, 140 species of birds have been observed, and by scientific planting and protection the number and variety of nesting birds have been greatly increased. Such a demonstration saves no species from extinction, but its educational value is

great because the thousands of visitors can see the result of wise methods.

If we add to all such protected lands the sanctuaries maintained by many local societies all over the United States, we find that the wildlife refuges of our country today have a total area equal to at least ten times the size of the six New England states. (See also Conservation.)

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BIRMINGHAM, ALA. A striking example of the industrial development of the new South is the growth of Birmingham. Its population jumped from about 26,000 in 1890 to about 300,000 in 1950—an elevenfold increase in only 60 years. In this short time it became a national leader in producing coal, iron, and steel—"the industrial center of the South."

The city itself is built partly on the slope of Red Mountain, so named from its outcrop of red hema-

tute iron ore. For many miles this iron ore extends in every direct on from the city in a vein from 6 to 26 feet thick. Birmingham is also the heart of the coal and limestone district of the South. Thus every thing is near at hand for the product on of steel symbolized by the 'Man of Iron' a 50 foot statue of the mythical blacksmith Vulcan atop Red Mountain.

Though Birmingham's prosperity is based on its enormous iron and steel plants it has become a center for diversified manufactures. It leads the country in the making of cast-iron pipe and has great rolling and steel plate mills, stove foundries and structural steel works. It also makes machinery of many kinds, brick and clay products, cement and cotton seed products. As by products of its huge coke industry it turns out a great variety of chemicals. Meat packing and corn milling are also important. It is one of the country's leading lumber markets shipping thousands of carloads of yellow pine every year to nearby and distant markets.

Another factor in Birmingham's prosperity is its excellent transportation. It is served by several railroads and is near the terminus of a water route to the Gulf of Mexico by way of the Black Warrior, Tombigbee and Mobile rivers. Hydroelectric plants on the rivers provide cheap and abundant power.

The city has many parks, a fine school system and an excellent public library with 12 branches. Leading educational institutions in Birmingham include the University of Alabama, College of Medicine, Birmingham-Southern College, Howard College and Miles College.

The city was founded in 1871 after the discovery of coal, iron ore and limestone deposits. It was named for Birmingham, the English industrial city. The American city is the trade hub of a large surrounding area. It is governed by three commissioners. Population (1950 census) 376,037.

BIRMINGHAM, ENGLAND. In almost the center of England, 113 miles northwest of London lies Birmingham. It is one of the greatest metal manufacturing cities in the world and the metropolis of England's industrial Midlands area. The town existed before the Norman Conquest and its manufactures date at least from the early 16th century. It was not until 1832, however, after one of the fiercest battles in the administrative reforms of that period, that Birmingham was given parliamentary representation. Its university, created in 1893, is one of the largest in the United Kingdom.

Toward the close of the 17th century Birmingham had gained wide importance as a manufacturing city due in large part to the extensive coal and iron beds that surround it. The leading industry today of the Birmingham district is metalworking of all sorts—foundry, rolling, stamping, plating, drawing. Manufactured products include machinery, engines, iron roofs, girders and all kinds of industrial wares. The manufacture of railway carriages is an extensive industry, and Birmingham is one of Great Britain's chief centers for the manufacture of automobiles.

ties and accessories. Other products are electrical apparatus, chemicals, brass goods, steel pens, screws and nails, buttons, pins, hooks and eyes, gold and silver articles and firearms.

In wartime Birmingham produces huge quantities of munitions and so it was fiercely bombed by the German air force during the second World War. Large areas of the city were wholly destroyed. It was near Birmingham at Soho that James Watt perfected his steam engine. Population (1951 census preliminary) 1,112,340.

BISMARCK, OTTO VON (1815-1898). Under Otto von Bismarck the iron chancellor, Germany rose from a weak confederation of states to a powerful empire. For most of the last half of the 19th century Bismarck's policies controlled the destinies of Europe. He was sometimes dictatorial, sometimes persuasive and often unscrupulous.



Germany's iron chancellor overruled all Europe.

He came from the aristocratic Junkers, a landholding class that provided the Prussian army and government with officers and officials. He was born April 1, 1815, at Schonhausen, a family estate. His full name was

Otto Eduard Leopold von Bismarck-Schonhausen. He spent his boyhood on another family estate, Knepphof, to the west of Berlin. Tall and strong, he loved to wander through the forests and to hunt fish and swim.

When he was 17 years old he began to study law at the University of Göttingen. He finished at the University of Berlin. Because of his wild and undisciplined nature, he was often in trouble with school authorities.

He rebelled too against continuing in a civil service appointment obtained by his family. After completing his compulsory military service, he helped manage the family estates. He entertained notoriously and his readiness to hunt, swim, or ride in any kind of weather led people to call him the mad Junker. Under his management the estates became more prosperous and his thoughtful reading schooled him in history, geography, literature, philosophy and theology. He tended toward agnosticism, but a relic of deeply religious neighbors brought him back to a sincere belief in God. His future wife, Johanna von Puttkamer, was a member of this circle. He married her in 1847 and the same year he entered politics.

Bismarck's Rise to Power

The end of the Napoleonic Wars (1815) had left the German states a loose confederacy. Bismarck entered politics determined to free the states from Austrian domination and to unite them under Prussian rule. During the European democratic revolutions of 1848, he staunchly defended the divine right of kings to

rule. He served the Hohenzollern king of Prussia as a representative at the assembly of the German confederation and as ambassador to Russia and France. In 1862 he was summoned to Berlin.

Because the Prussian parliament had refused plans William I had proposed for a larger army, the king was ready to abdicate. Bismarck persuaded the king to remain on the throne and was appointed minister-president of Prussia. Under the king's authority Bismarck dismissed the parliament.

In 1864, employing hated Austria as an ally, he warred against Denmark. Victory won them the Schleswig-Holstein duchies. William I made Bismarck a count. Quarrels over administration of the duchies led, in 1866, to war with Austria. The quick defeat of Austria gave Prussia control over the states north of the Main River. Bismarck formed them into the North German Confederation, with himself as chancellor under the Prussian king as president.

During the next four years relations between Prussia and its age-old enemy France became tense. In 1870 the nomination of a Hohenzollern prince to the vacant Spanish throne was withdrawn upon French demand. When the French ambassador asked William I to promise that the nomination would never be renewed, the king brusquely dismissed him. A message, called the "Ems dispatch," describing the incident was sent to Bismarck to pass on to the public. Before releasing the news, Bismarck so altered the meaning of the dispatch that it appeared that William I had grievously insulted the French.

France declared war. The already-prepared German army invaded France. All German states aided Prussia (see Franco-Prussian War). Germany's victory was complete. In the enthusiasm of victory, the German states agreed to unite in the German Empire. William I became *kaiser*, or emperor; Bismarck, raised to the rank of prince, became chancellor.

Bismarck served as chancellor for 19 years. In that time he largely shaped European policies. He resisted Vatican claims to temporal authority within Germany but after a long dispute he partially gave way. During his chancellorship, Germany established colonies in Africa and in the Pacific. To prevent labor unrest while Germany built up its industries, he had the government give old-age pensions and sickness and accident benefits to workers.

William I was succeeded on the throne in 1888 by his son Frederick III, a sick man who ruled only three months. Frederick's son, William II, then only 29 years old, ascended the imperial throne. Because he wanted to wield sole power, he dismissed Bismarck in 1890. Prince Bismarck retired to one of his estates. There he criticized the reign of William II and wrote his memoirs. He died July 30, 1898. (See also Germany; William, German Emperors.)

BISMARCK, N. D. An army post built at a ford of the Missouri River in what is now the south-central part of the state led to the settlement of Bismarck, North Dakota's capital. A railroad was being built westward from Fargo. The post was established to

protect its construction workers from Indian attacks. The settlement that grew around it was called The Crossing. In 1873, the year the railroad reached the ford, it was renamed Bismarck, after the chancellor of Germany, in hopes of securing German capital for the railroad.

Rails were not laid west of Bismarck until 1879. In 1874 the discovery of gold in the Black Hills, 200 miles south, brought many gold seekers. Bismarck prospered as a wagon and stage transport center for the gold fields and for settlements still farther west. It was made the capital of the Dakota Territory in 1883, and it continued as capital when North Dakota entered the Union in 1889. In 1951 the discovery of petroleum within the state brought about a new boom.

Bismarck occupies low hills on the east bank of the river; beyond low flats of the river's west bank lies the sister city of Mandan. Bismarck's outstanding sight is its 18-story Capitol. Nearby are the state penitentiary and Fort Abraham Lincoln State Park. The city itself has more than 700 acres of parks.

Bismarck's workers are employed in state and federal offices, in wholesale distributing firms, and in flour mills, creameries, grain elevators, and seed-houses. The city has the commission form of government. (See also North Dakota.) Population (1950 census), 18,640.

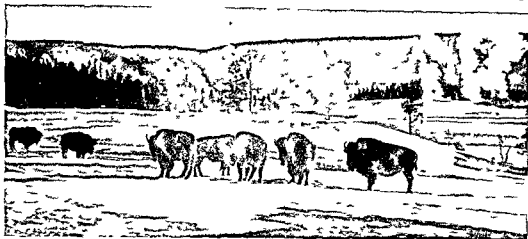
BISMUTH. The metal bismuth is used in medicines and in nonferrous alloys that have low melting points. Certain salts of bismuth are used in indigestion remedies to soothe irritated mucous membranes; others are injected into the body to kill germs. Salves, ointments, and healing powders also contain compounds of bismuth. Its salts were formerly fed to patients for most X-rays of the digestive tract, because in the radiograph the salts clearly outline the intestines and stomach. Today the less soluble barium sulfate is generally used.

Various alloys of bismuth serve as safety plugs in automatic fire sprinklers and boilers. Pure bismuth does not melt below 520° F., but its alloys with lead, tin, and cadmium melt at below the boiling point of water (see Alloys). When a fire starts or a boiler overheats, the heat melts the safety plugs.

Like antimony, bismuth expands when passing from the melted to the solid state. Because it does not shrink when hardening, its alloys are used for making molds and molded objects, notably dental models. It is also used for plastics and optical glass.

In Bolivia and Germany, large amounts of bismuth occur in the pure state. Elsewhere it is usually found with ores of lead, copper, tin, and other metals, from which it is separated as a by-product at refineries. The United States, Peru, Mexico, Spain, Canada, Germany, and Japan are the chief producers.

Bismuth belongs to the nitrogen group of elements. It is brittle, lustrous, and white tinged with red. It is slightly heavier and softer than copper. The specific gravity of bismuth is 9.8; hardness on Mohs scale, 2-2.5; symbol, Bi; atomic number, 83; atomic weight, 209; valences, 3 and 5.



Steam plumes of Yellowstone Park's hot springs billow upward beyond a few of the bison in the park's carefully preserved herd. Once millions of these great animals grazed over the broad plains, now only a few thousand remain.

The BUFFALO—MONARCH of the PLAINS

BISON The American bison (*Bison bison*) more commonly called buffalo is the largest of North American mammals. Originally great herds ranged from Mexico to the region of Great Slave Lake in Canada and from Pennsylvania and the Carolinas to west of the Rockies. Their food was the grass and leaves of sparse forest and prairie lands.

At the time America was discovered it was estimated that from 30 to 60 million bison ranged this area. In 1870 the existing number was estimated at 5½ million. In the days of pioneer travel great bison herds wading and swimming streams sometimes halted a boat in midstream or moving over the prairie blocked and occasionally even derailed a train. As late as 1871 a traveler in Arkansas wrote that he had ridden his horse to the center of a vast herd that extended six to ten miles in every direction.

The westward moving pioneers and railroad workers armed with the newly invented repeating rifle killed the great beasts by the thousands. Only the choicest pieces of the slaughtered bison—the hump and tongues—were cut out of the carcasses. The rest was left to rot in the prairie sun. Legend has it that Sitting Bull, a famous Sioux chief, and a band of warriors in 1883 slaughtered the last thousand head of bison remaining in southwestern Dakota. Fewer than another thousand were then left on the American continent and two thirds of these were in Canada.

For the Plains Indians the bison was the most important game animal. Its hide furnished material for tepees and robes; its meat, almost as tasty as beef, was eaten fresh or made into pemmican, a nutritious preparation of dried meat and fat. Dried dung was fuel for cooking fires.

What the Bison Looks Like

The bison's massive head is its most characteristic feature. Its forehead bulges because of its convex

shaped frontal bone. Its shoulder hump, dwindling bowl-like to the haunches, is supported by unusually long spinal vertebrae. Over powerful neck and shoulder muscles grows a great shaggy coat of curly brown fur, and over the head like an immense hood grows a shock of black hair. Its forequarters are higher and much heavier than its haunches.

The adult male stands about five and a half feet high at the shoulders, is nine to ten feet long and weighs from 2,000 to 2,600 pounds. The female is smaller, not exceeding 1,500 pounds. One of the largest specimens now in the United States National Museum at Washington, D. C., was shot in Montana in December 1886 by Dr. William T. Hornaday. In spite of its size and bulk, the bison travels swiftly.

The bison's horns are short and black; in the male they are thick at the base and taper abruptly to sharp points as they curve outward and upward. The female's horns are more slender. The hoofs are short, broad and black. The gestation period is from nine to nine and a half months, and the calves are born from April to June.

A bison's general color is pale brown, darker on the head and shoulders and underneath. The forepart hair is 10 to 15 inches long on the head and somewhat shorter on the neck, shoulders and forelegs. Hair resembling a beard grows 10 to 12 inches long under the chin. The rear and lower portions of the body are covered with short, soft, woolly hair. The tail ends in a tuft of coarse hair 12 to 18 inches long. The forepart hair is permanent, but the hair on the hind portions is shed annually, beginning in March. By early summer these parts are quite bare and very sensitive. For protection against insect bites a bison wallows in muddy sloughs or shallow ponds. The wallowing covers its body with mud or clay. When this dries in the sun it forms a protecting cover that stays on for several days.

The new hair is well grown by October and at its best in November and December. The hide then is valuable as fur. Before the bison became nearly extinct buffalo coats—overcoats made of the fur of young bison—were in common use and were remarkably cheap. White men obtained many a prime buffalo robe from the Indians in exchange for as little as a pound of tobacco, a few trinkets, or a pint of whiskey (see Indians, American)

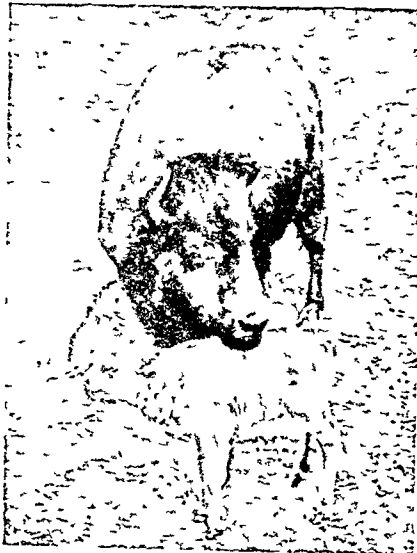
The great bison herds moved northward in the spring and southward in late fall. The migrations covered hundreds of miles. During these times the great beasts swam swift-flowing rivers and climbed or descended steep banks and even cliffs.

The routes were the same year after year. The southward movement was made usually in single file, and the bison trails in some places were worn as much as two or three feet deep. The northward movement began in the spring, after the calves were strong enough for travel. In this movement the herds were smaller. The bulls ranged in an outer circle about the cows and calves. When threatened, the herd bunched and the bulls faced outward toward the danger.

The Bison's Enemies

Bison needed to cope with many foes besides the Indians and white hunters. Coyotes and gray wolves

BULL AND CALF



A bison bull stands guard over a tiny calf. The calf's sturdy little legs grow strong quickly and soon after the calf is born it can travel.

slunk close to the herd, ready for a sudden pounce on a straggling calf. Only a fierce grizzly, however, would dare to do battle with the bison bull. Ice weakened by the spring sun would sometimes break under the immense weight of a migrating herd; in such an accident usually many of the animals would drown.

For a long time no one seemed interested in preserving the fast-disappearing bison. True, two or three ranchmen tried to protect a few that grazed on their ranges. Finally under urgings of these and other conservationists, Congress in 1902 appropriated money to assemble the surviving bison in Yellowstone National Park.

Fortunately the bison breeds readily in captivity. Bison in herds in the United States now

number more than 5,000. These include a herd of many head in the Lamar Valley in Yellowstone National Park. A few hundred more are in Alaska. Canada has several thousand, chiefly in its national parks. (For illustration of the bison in color, see North America.)

Bison Varieties

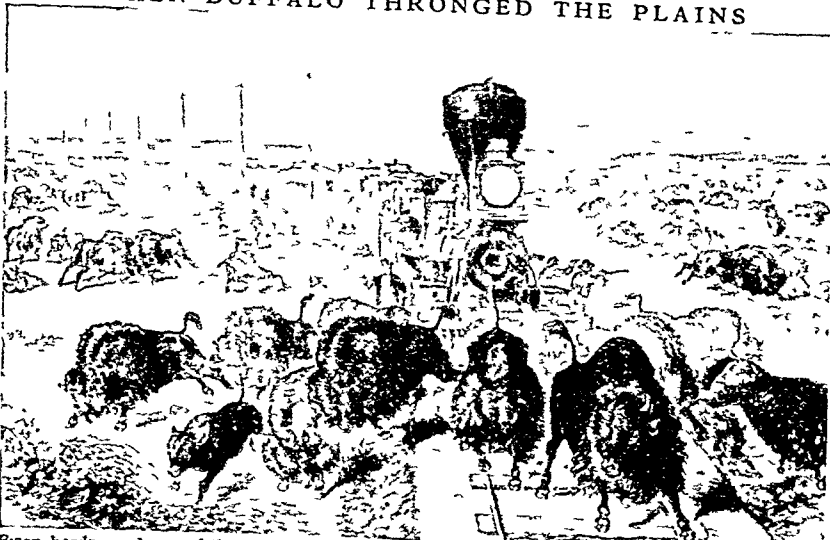
Almost all the American bison alive today are the Plains bison. Another variety, larger and darker in color, called the wood bison, until recently survived in northern Canada. They now are nearly extinct

through interbreeding with the Plains bison. A hybrid called *cattalo* has been produced by breeding the male bison with a domestic cow (see Cattle)

The European bison, called *wisent* by the Germans, flourished in Europe centuries ago and until the first World War 1,500 head were kept in preserves in the Caucasus and in Lithuania by the Russian czar. These herds now are all but extinct. A few animals remain in European zoos.

These bison should not be confused with the extinct wild ox, or *urus*, of Europe,

WHEN BUFFALO THROGGED THE PLAINS



Bison herds, made up of thousands of the great animals, sometimes blocked the "iron trails" of early Western railroads. This Berghaus woodcut

shows trainmen and passengers of a stalled Kansas-Pacific train joining efforts to frighten the herd from the track by shooting some of them.

which before its disappearance was also known as the 'aurochs' The European bison is smaller than the American bison, and it ranged in smaller herds It is black or deep brown in color

The skeleton of the first American bison exhibited in Paris in 1819 happened to be that of a freak having 15 pairs of ribs and so for a time the American bison was thought to have that number Actually both the European and the American bison have but 14 pairs of ribs The true buffalo belongs to India and Africa and differs from the bison in that it has neither the bison's hump on the shoulders nor its long hair on the fore part of the body (see Buffalo)

BITTERN The booming call of the American bittern is a familiar sound over springtime marshes Hunters call the bird the thunder pumper or "stake driver" because its ump-up, ump up sounds like an old fashioned wooden pump or like the pounding of a stake into the ground The sound is hard to locate, for the bird is a skillful ventriloquist and presents a fine example of protective coloration When an enemy approaches it stretches its head and bill upward and remains motionless, the streaked brown neck blending in with the marsh reeds to make it look like a stick

The American bittern is about two feet tall The back is brown streaked with black, the under parts buff streaked with brown Black wing tips show on flight Male and female look alike except in the mating season when the male has white or buffy ruffs on the sides of the breast

The shy, secretive least bittern is half the size of the American bittern It is more colorfully marked, with greenish-black back, crown, and tail, chestnut neck and wing patches, and buffy under parts Both birds live in marshes of temperate North America They winter from the Gulf states southward The bitterns are members of the heron family, *Ardeidae* The scientific name of the American bittern is *Botaurus lentiginosus*, of the least bittern, *Izobrychus exilis*

BITTERSWEET. Seen against the dry browns of autumn the bittersweet gives to the woods of the eastern United States dashes of glowing color The bright orange capsules burst open when touched by

frost and curling back disclose the brilliant scarlet fruit within The bittersweet is a treelike vine It twines its woody stem about trees with great strength, sometimes killing young saplings It may twist its own stems into a strong rope The small creamy-white

flowers appear in June The berries develop in September and if gathered then and allowed to dry will brighten the house all winter

The bittersweet nightshade is a totally different vine It is a member of the nightshade family and bears drooping clusters of blue or purplish flowers shaped like potato blossoms but much smaller It grows in swamps from Nova Scotia to Minnesota and south to New Jersey and Kansas. The bright red berries are poisonous From the twigs an extract is prepared which is sometimes used as an ingre-

redient in medicine The scientific name of the bittersweet is *Calcestrus scandens* of the bitter sweet nightshade *Solanum dulcamara*

BIZET (be-zé) GEORGES (1838-1875) The musical fame of Georges Bizet rests principally on his opera 'Carmen' Its warmth, changes of mood and its rhythms make it one of the most popular operas The opera and selections from it as well as some of Bizet's earlier works, are often played today

Bizet was born in Paris on Oct 25 1838 His father was a singing master and his mother, a master of a great pianist Bizet was christened Alexandre César Léopold but was better known as Georges Because he early displayed musical talent, the frail, wavy haired boy was accepted by the Paris Conservatory when he was nine years old There he studied piano, organ, harmony, and composition When only 11 years old he won the first of several prizes He was awarded the Grand Prix de Rome, a five-year French government scholarship, when he was 19 He studied three years in Rome Though weak in body, Bizet was intelligent and ambitious

While in Rome he wrote an opera, two symphonic movements and an overture, all rather imitative of

HEARD BUT SELDOM SEEN



When not concealing itself a bittern is a very lively creature. The male above looks very cocky. The watchful least bittern at the left lifts its long bill upward as it "freezes" on its nest. Its colors blend so well with the swamp reeds that from even a short distance only its yellow eye can be seen.



other composers. Some time after his return to Paris in 1860 his work won general recognition. His operas 'Les Pêcheurs de Perles' and 'La Jolie Fille de Perth' were rather unsuccessful. Bizet was forced to add to a scanty income by doing orchestrations and other hack work for music publishers. In 1869 he married Geneviève Halévy, daughter of his composition teacher at the conservatory; they had one son. Bizet's incidental music for Alphonse Daudet's play 'L'Arlésienne' was his first popular success.

He composed 'Carmen' in 1874. The libretto was drawn from a tale by Prosper Mérimée and deals with a beautiful, scheming, corrupt gipsy girl, a Spanish soldier she entices into crime, and the innocent girl who loves him. On opening in Paris March 3, 1875, it was severely criticized for the boldness of the story and for a Wagnerian influence that the critics thought they detected in the music. But it continued to run until after the disappointed, overworked, and sickly Bizet died on June 3, 1875. In the years after his death 'Carmen' became increasingly popular.

BJÖRNSON (*byörn'son*), **BJÖRNSTJERNE** (*byörnst'yêr-nâ*) (1832-1910). The poet, playwright, and novelist Bjørnstjerne Bjørnson is among Norway's great literary figures. Of its dramatists only Ibsen outranks him. Although his works are largely Norwegian in locale and inspiration, they have been admired by the whole world. In 1903 he was awarded the Nobel prize in literature. A great patriot, he helped to bring about the separation of Norway from Sweden, which took place in 1905.

Bjørnson, the son of a Lutheran pastor, was born Dec. 8, 1832, in Kvikne, a village of central Norway. As early as his undergraduate days at Christiania University he published newspaper articles and dramatic criticisms. He left the university before graduation to accept a full-time newspaper job. 'Synnöve Solbakken', his first novel, published when he was 25 years old, made a deep and lasting impression. It was the first of a series dealing with Norwegian peasant life. These were written in the simple style of the old sagas. His drama 'Between

GEORGES BIZET



The composer's best-known work is the opera 'Carmen'.

the Battles', written when he was 23, was played the same year.

Bjørnson's interest in the drama won him an appointment as manager of the Bergen Theater. On a government stipend he traveled in Italy, France, and Germany to study their dramatic techniques. His first plays deal with periods in Norwegian history. Later, like Ibsen but with considerable more optimism, he found his material in the social problems of the day. Because of his efforts to free Norway from Sweden he suffered a short exile before 1900.

Bjørnson wrote many books, short stories, and plays. He did not produce poetry so prolifically, but one of his poems became Norway's national hymn. Among his best stories and novels are: 'A Happy Boy' (1860); 'The Fisher Maiden' (1868); and 'The Heritage of the Kurts' (1884). His dramas include 'Sigurd Slembe' (1862); 'Sigurd Jorsalfar' (1872); 'The Editor' (1874); 'A Bankruptcy' (1874); 'The King' (1877); and 'Beyond Our Power' (Part I, 1883; Part II, 1893).

BLACKBERRY. The most extensive cultivation of the blackberry is in the United States, though it grows abundantly in the British Isles. There it usually is known as the "bramble." It belongs to the same genus as the raspberry, from which it is distinguished by its plumper and larger berry and by the fact that the conical receptacle comes away with it when the berry is picked. More than 25 varieties have been developed in this country, among them a white thornless variety. They are propagated chiefly from suckers and root cuttings. Blackberries belong to the genus *Rubus*. The trailing,

or low, blackberry (*Rubus flagellaris*) often is called the "dewberry." (For illustration in color, see Fruits.)

BLACKBIRD. Various relatives of the meadowlarks and orioles are known as blackbirds. The grackles and cowbirds, the red-winged, yellow-headed, rusty, and Brewer's blackbirds are members of this large group. Their habits differ considerably. They may nest in marshes, on dry prairies, or in dense evergreen forests. Some have musical songs, especially the redwings. Others, with much wing fluttering, bobbing, and wagging of tails produce only a medley of harsh squeaks and gurgling clucks. Blackbirds are valued birds on their summer nesting grounds, where they feed on weed seeds and insects. In late summer and fall, however, they gather in large flocks and devour ripening grain.

Red-winged blackbirds live in cattail marshes from the Atlantic coast to the Rocky Mountains.

A REDWING AT THE NEST



The male red-winged blackbird feeds its young in a nest fastened to marsh reeds.

From the top of a swaying plant the male sings his liquid *conk-er-ee* and flutters his wings to display the beautiful scarlet shoulder patches. The streaked brown female looks like a large sparrow. The nest of coarse grasses and weed stalks is lashed to the stems of marsh plants. (For pictures in color see *Birds Egg*)

The yellow headed blackbird of the Western Plains also nests in marshes. It has yellow-orange head, neck and upper breast and white shoulder patches. Another familiar blackbird often seen walking jerkily over lawns is the grackle. It is larger than the red wing with a long tail shaped like the keel of a boat. At a distance it seems to be all black but in a good light the dark purple or bronze colors gleam like polished metal. The purple grackle lives east of the Allegheny Mountains. The bronzed grackle lives from the Alleghenies to the Rockies. The boat-tailed grackle of the south Atlantic and Gulf coasts is the largest of the blackbirds—about 16 inches long.

The cowbird is common in fields and in pastures. It has a brown head and glossy black body. It is a bad parent. It makes no nest and lays its eggs in the nests of other birds. The rusty and Brewer's blackbirds nest in northern evergreen forests. They are seen in the United States during migrations. They resemble red wings and are often found in flocks with them but they are black with greenish or purplish black heads.

Blackbirds belong to the family *Icteridae* to which the orioles, meadowlarks and bobolinks also belong. The European blackbird is a member of the thrush family. It is a beautiful singer and a popular cage bird. The scientific name of the red winged blackbird is *Agelaius phoeniceus*. Of the yellow headed blackbird *Xanthocephalus xanthocephalus*, bronzed and purple grackle *Quiscalus quiscula*, boat-tailed grackle *Cassidix mexicanus*, cowbird *Molothrus ater*, Brewer's blackbird *Euphagus cyanocephalus*, rusty blackbird *Euphagus carolinus*.

BLACK DEATH I leave parchment for continuing the work if haply any man survive this pestilence. A despondent English monk wrote this in his chronicle while the terrible plague called the Black Death raged in England in 1349. He had good reason to despair. The epidemic killed at least a fourth of the people of Europe in four years.

The Black Death killed swiftly. A victim shivered, his temperature rose and swellings appeared in his neck, armpits or groin. Frequently death resulted in 12 hours.

The Black Death helped to end the feudal structure of medieval society. Before the plague England

had about 5 million inhabitants; only about three fourths survived. Those field laborers left demanded increased wages. Many peasants fled to the towns or found places elsewhere where their lot was easier. Parliament passed laws to keep wages at their former

levels but these could not be enforced. As a result the old manorial system of a peasant giving his labor in return for use of a lord's land broke down in England. The land was either rented to tenant farmers or else the lord grazed sheep on the land.

The same disease has caused many historic epidemics. During the Peloponnesian War it broke out in the city of Athens (430 B.C.). In the reign of the Roman Emperor Justinian grain ships from Egypt brought it to Constantinople. Boccaccio places the scene of his *Decameron* in the hills about Florence, Italy, during the epidemic of 1347. Defoe describes the outbreak of 1665—the Great Plague—in London.

Today we call this disease the bubonic plague. It came originally from Asia. The germ that causes it is carried by a certain kind of flea

which lives on rats. Medical science and sanitation checked its ravages in the Western World, but health officers must keep constant watch at seaports to prevent the disease from breaking out again.

BLACK FOREST, GERMANY. Tales of dwarfs and elves and fairies haunt every valley and wooded height in the famous Black Forest of Germany. Scores of nursery tales grew up in the mysterious depths of this wooded mountain region.

The Black Forest lies in the elbow formed by the Rhine River as it flows westward from Lake Constance and turns sharply to the north. Stretching northward—mile after mile—are the rounded mountains crowned with dark belts of pine and fir. The people call them *Schwarzwald*, meaning black forest. The length of the chain is about 100 miles and its average width is 24 miles. The loftiest elevation is the round topped Feldberg, 4,996 feet high.

The woodlands are beautifully kept. A tree felled by the wind or blasted by lightning is immediately removed and all broken twigs and branches are taken for fuel. The upkeep of the forest furnishes the inhabitants with the chief means of support.

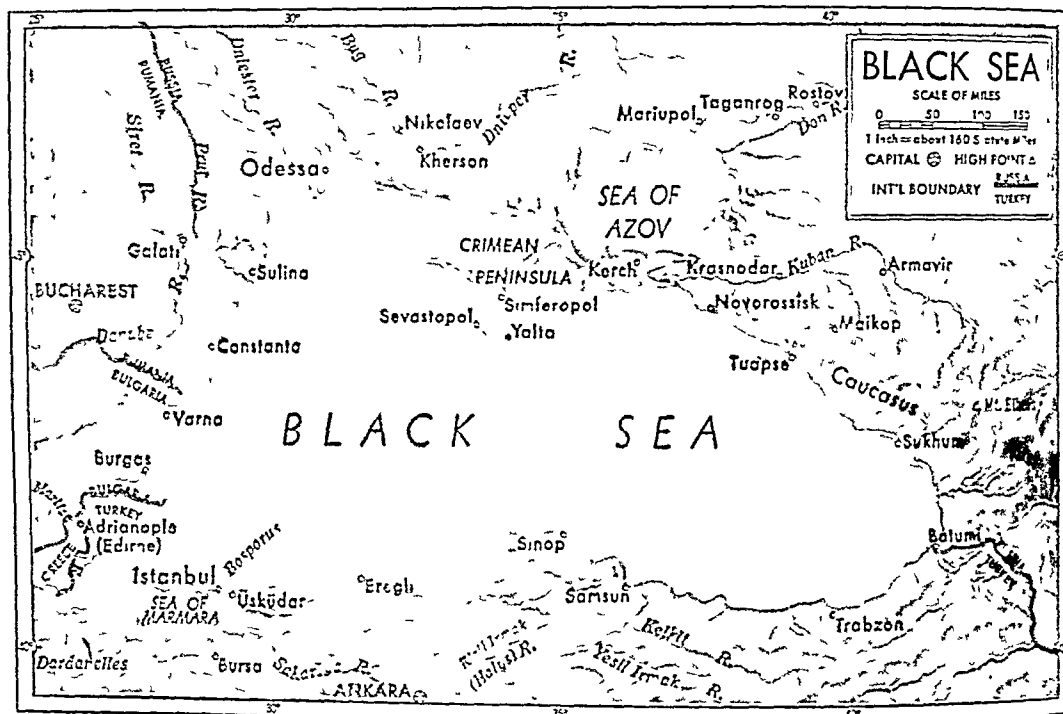
Every spring the seeds of a future forest are planted in nurseries. Pine and fir predominate but such other varieties as maple, ash, birch, walnut and even fruit trees are also sown. Trees planted by one generation are cared for by the next and are cut down and sawed into lumber by the third.

The beautiful Danube and Neckar rivers rise in these mountains. Along these and other streams are

A FOUR-STORY WARBLER NEST



The cowbird is a parasite that lays its eggs in the nests of other birds. A favorite victim is the yellow warbler, which may rebuild its nest repeatedly to avoid incubating the overwintered egg.



This great inland sea opens into the Mediterranean through the narrow gateways of the Bosphorus and the Dardanelles. Into the mighty Danube and three great rivers of Russia pour their waters. Except in the north, the coast is mountainous.

little manufacturing towns. Cattle graze on the grassy slopes, and the beauty of the region makes it a favorite summer resort. The greater part of the Black Forest is in South Baden (see Baden).

BLACK SEA. The Balkan peninsula thrusting southward from Europe and the peninsula of Anatolia (Asia Minor) projecting westward from Asia enclose between them the Black Sea. This sea connects with the Mediterranean through the narrows of the Bosphorus and the Dardanelles. Including the Sea of Azov, the area of the Black Sea is about 180,000 square miles—some six times the size of Lake Superior and one fifth as large as the Mediterranean. Its greatest length is 750 miles; its greatest width, 380 miles; and its greatest depth, 7,382 feet. It has no important islands, and its harbors are usually ice-free.

The Black Sea drains nearly one quarter of the surface of Europe. The large inflow of fresh water makes it much less salt than the ocean and sets up a peculiar current. In the upper levels fresh water flows outward toward the Bosphorus; in the lower levels salt water from the Mediterranean flows inward. The great rivers that flow into the Black Sea are the Danube, the Dniester, the Bug, the Dnieper, the Don, and the Kuban. The mouths of these streams are shallow and elsewhere the coast line is so unbroken that almost all the Black Sea harbors are artificial. Sevastopol, the only important natural harbor, is a naval base. The other large ports are Constanta, Odessa, Nikolaev, Kherson, Novorossisk, Trabzon, and Samsun.

Lying where Europe and Asia meet, the Black Sea has been important for 30 centuries. It was traversed by the ships of early pirates, traders, and settlers of explorers and conquerors. After the Turks captured Constantinople in 1453, they closed the sea to all but their own ships. The Russians later obtained rights of passage for their vessels. For them the Black Sea, with its Mediterranean outlets, is so vital an avenue of transportation that it has always had a great influence on Russia's foreign policies. The fact that the Turks were able to block the entrance to the Dardanelles during the first World War tended to prolong that struggle and contributed to Russia's defeat. In 1923, by international agreement, the straits were opened to all peacetime commerce (see also Dardanelles).

In the second World War, much of the heaviest fighting between the Russians and the Germans surged back and forth along the northern shores of the Black Sea from the Caucasus to the Danube. And at Yalta in the Crimea, the "Big Three" Allied leaders met in 1945 to plan the final strategy. The peace treaties after the war left the Black Sea boundaries untouched, but control of the Dardanelles became an international problem for the United Nations.

Because the Black Sea was dangerous to the small ships of ancient times, the early Greeks called it *Axeinos* ("unhospitable"). Later, in the 7th century B.C., when they colonized its shores, they renamed it *Euxeinos* ("hospitable"). It is no more hazardous than other inland seas of its size.

BLACKSMITHING The glow of a forge the ringing clang of hammer against anvil the sizzle of heated iron or steel cooled suddenly in water and the neigh and stamp of horses were familiar sights and sounds of the blacksmith's shop. In it the blacksmith shoed horses and made and repaired carriages wagons tools and machinery.

Until well into the 1900's the community blacksmith shop was a familiar place. Children on the way home from school could peer through the open door into the cool interior made dark by smoke from the forge. They would see the leather aproned smith thrust tongs into the forge and pull out pieces of whitely glowing iron see him turn quickly to the anvil put the pieces together and then hammer them hard to weld them into one piece. They watched as he hammered the piece into the shape that was wanted. Longfellow wrote *The Village Blacksmith* about the smith in such a shop. In many villages the blacksmith's shop was a gathering place for farmers doctors lawyers and businessmen a place where they talked over the problems and politics of the day.

There are few blacksmith shops today. This is because there are fewer horses to shoe because wagons and carriages have given way to trucks and cars and because parts are now made by machines. Shops that weld metals by the heat of gas flames or electric current instead of the forge now do some of the blacksmith's work. Still more is done in tool and die-making shops and in the rolling and forging mills of the steel industry. Many farmers now have small forges of their own where they can repair plows other farm tools and machinery. About all that is left for the blacksmith is his farmer's task—the shoeing of horses. (See also *Iron and Steel Metal Working Welding Wire*)

A BLACKSMITH SHOP



This smith shapes a talk on one glowing end of a horseshoe. On the forge at his left are piled shoes already calked. Be-

low these are some of his many tongs. The handle which works the bellows can be seen just below the smith's left shoulder.

The floor space of a blacksmith shop must be rather large for it must hold the wagons plows and horses that the smith is to work on. The shop has a work bench a water tub an anvil a tool table a forge and a coalbin. It also has horseshoe racks and racks to hold the iron and steel rods and sheets used by the blacksmith to make new and to repair old articles. There may be a drill press. The floor around the forge and anvil may be either concrete packed earth or wood covered by sheet iron. This is so the chips of hot metal that fly under pounding will not set fire to the floor. The remainder of the floor may be made of planks.

The coal used by a blacksmith must be relatively free of sulfur and other chemicals that would damage the iron or steel if they were absorbed while in the fire. Coke or charcoal may also be used for making forge fires.

The anvil placed about six feet from the forge is made of steel. It rests on a block of wood that extends downward into the earth two feet below the floor surface. Its face (or oblong flat top) is case-hardened so that it will not dent under heavy blows. The horn is the pointed rounded portion; it is also case-hardened. All except a $\frac{1}{4}$ inch of the face's edge is sharp and square. In the top of the face are two holes: one square and one round. The first is called a *hard hole*; the second a *spud hole*. The horn, the rounded and sharp edges and the holes are helpful to the smith in shaping and cutting the metal he works on.

A blacksmith's tongs are of several sizes and have jaws of various kinds. They are designed to hold such different shapes as flat pieces and rods. A blacksmith's ball-peen hammer weighs about two pounds. On heavy work he swings sledges of varying weights. Other tools

include *hot chisels* and *cold chisels* (for cutting hot and cold iron and steel) and shaped instruments called *flatters*, *sets*, *fullers* and *swages* (used for flattening or forming special shapes in iron and steel).

Smithing is one of the oldest crafts. It began with the first use of metal and after men discovered iron it became increasingly important. The first iron objects probably were shaped by a labored pounding of cold metal. In time it was discovered that heated metal shaped more easily. The steel of the famous Damascus swords was refined and shaped by heating and hammering. Time and experience brought new knowledge in the refining, shaping and tempering of iron and steel and this in turn brought a limitless multitude of uses for the blacksmith's products.

BLACKSTONE, SIR WILLIAM (1723-1780). His four-volume 'Commentaries on the Laws of England' has made Sir William Blackstone the best known of English and American writers on the law. For many years after his death the 'Commentaries' served as textbooks for the teaching of law both in England and in America. Jurists of many countries cite the 'Commentaries' as a source for some of their rulings. Although all four volumes of the 'Commentaries' appeared in the 1760's, they remain one of the best general histories of English law.



Sir William Blackstone wrote the famous 'Commentaries'.

Blackstone's father died before William's birth in London, July 10, 1723. His mother died before he was 12. He was reared by an older brother. When 15 he left Charterhouse School to enter Oxford. At Charterhouse he received a medal for poetry, and he continued his literary efforts at Oxford. At 18, upon beginning the study of law, he wrote the poem 'The Lawyer's Farewell to His Muse' that since has been often reprinted. He was called to the bar in 1746.

Blackstone had few cases, perhaps because he had few influential friends. He returned to Oxford as bursar of a college. His first work on jurisprudence appeared in 1750. This and succeeding works won him a reputation. At that time no Oxford college had a course on law. When one was founded in 1758, Blackstone was appointed professor. His lectures attracted wide attention, and he again entered the practice of law.

In 1761 Blackstone married and was elected to Parliament. In the same year he refused the chief justiceship of Ireland. In 1763 he was appointed solicitor general to the queen. Because of failing health and a big increase in his law practice, he resigned his professorship in 1766.

In 1765, meanwhile, the first volume of the 'Commentaries' had appeared; the last volume was published in 1769. The 'Commentaries' were an immediate and popular success. Eight editions were printed in the author's remaining 11 years of life. In the 1770's he was appointed a judge and knighted. Blackstone had nine children. He died Feb. 14, 1780, and was buried at Wallingford, where he had spent his last and most successful years.

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BLACKWELL, ELIZABETH (1821-1910). When Elizabeth Blackwell was graduated as a doctor of medicine in 1849, she became the first woman doctor in the United States. Her enrollment in the Medical Register of the United Kingdom in 1859 made her Europe's first modern woman doctor.

Elizabeth was born Feb. 3, 1821, in Bristol, England. She was one of nine children of Samuel Black-

well, a prosperous sugar refiner. His beliefs in social justice and equal educational opportunities for women inspired his children. Almost all became notable figures in the world.

The Blackwells immigrated to New York City in 1832. There the family was active in the abolitionist movement. Their refinery did not prosper, and in 1838 they moved to Cincinnati, Ohio. Samuel Blackwell died a few months after the move. The need for the boys to find work and the girls to start school did not prevent the Blackwells from aiding escaped slaves or from participating in intellectual movements.

It was in 1844 that slight, yellow-haired Elizabeth Blackwell determined to become a doctor. Because no medical school would admit her, she studied privately with doctors in the South and in Philadelphia. In 1847 the Geneva Medical School of western New York accepted her. The acceptance evoked a storm of ridicule and criticism, but in spite of slights and embarrassments Elizabeth pursued her studies. In 1849 she was graduated at the head of her class.

Paris then was the foremost medical center. Dr. Blackwell journeyed there to undertake advanced studies, but Paris doctors proved as intolerant as their American colleagues. They would not permit her to study as a doctor. She was forced to enter a large maternity hospital as a student midwife. There she contracted an infection that caused her to lose one eye. After convalescence, she went to London, where she was permitted to continue her studies in St. Bartholomew's Hospital.

On her return to New York City in 1850, Dr. Blackwell was not permitted to practice in any hospital. Other women now sought to follow her into medicine. Dr. Blackwell fought for her own and other women's rights to learn and practice. She started the New York Infirmary for Women and Children, aided by her sister Emily and other women who became doctors and by several tolerant Quakers. Her leadership in meeting the medical problems presented by the Civil War won her recognition. With her sister she opened a medical college for women in her hospital.

Dr. Blackwell wrote and lectured. A series of lectures which she delivered in England in 1859 brought her recognition in Britain. After the Civil War she settled in England. Her work and her friendship with Florence Nightingale and other intellectual leaders of the day opened the way for English women to enter the field of medicine. Her lectures and books dealt largely with social hygiene and with preventive medicine. She died May 31, 1910, at her home in Hastings.

ELIZABETH BLACKWELL



She was the first American woman to become a doctor.

BLAINE JAMES GILLESPIE (1830-1893) The plumed knight of the Republican party was Blaine Lake Webster Clay and Calhoun he disappointed himself and his friends by just missing the presidency Born in Washington County western Pennsylvania he graduated at 17 from Washington College At 26 he was editor of the *Kennebec Journal* of Augusta Me He helped organize the new Republican party in Maine and was a member of the state legislature He went to Congress where he was speaker for three years then to the United States Senate He was secretary of state under Presidents Garfield and Harrison In 1876 and again in 1880 Blaine failed to win the Republican nomination for the presidency When he did get it in 1884 he lost the elect on largely because a group in his own party called Mugwumps threw the r support to the Democratic candidate Grover Cleveland

BLAKE ADMIRAL ROBERT (1599-1657) England's greatest admiral in the period of the Commonwealth was Robert Blake He was born in Bridgewater Somersetshire and educated at Oxford His puritan fellow townsmen chose him as their member in the Short Parliament of 1640 When civil war broke out in 1642 Blake joined Oliver Cromwell's parliamentary army In 1649 he was appointed a general of the sea and succeeded in destroying almost all the Royalist fleet

When the Dutch war broke out Blake waged a bitter fight against the Dutch admirals De Ruyter and Tromp Later he crushed the Barbary pirates in the Mediterranean a task set for him by Cromwell in 1654 In the war against Spain that soon followed Blake revived memories of Sir Francis Drake's exploits by annihilating the Spanish fleet in the harbor of Santa Cruz in the Canary Islands He died on his way home from this victory as his ship was nearing Plymouth

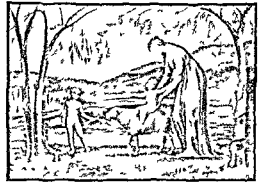
BLAKE WILLIAM (1757-1807) I do not behold the outward creation to me it is a hindrance and not action Thus William Blake—painter engraver and poet—explained why his work was filled with religious visions rather than with subjects from everyday life Few men in his time realized that Blake expressed these visions with a talent that approached genius He lived in near poverty and died unrecognized Today however Blake is acclaimed one of England's great men of art and literature

Blake was born Nov 28 1757 in London His father kept a hosiery shop William was the third of five children He went to school only long enough to learn to read and write and then he worked in the shop until he was 14 Seeing the boy's talent for drawing Blake's father apprenticed him to an engraver Blake became skilled in this difficult craft He copied the works of famous painters and engravers and spent months in such places as Westminster Abbey making drawings

At 25 Blake married Catherine Boucher He taught her to read and write and to help him in his work They had no children They worked together to pro-

duce an edition of Blake's poems and drawings called *Songs of Innocence* Blake engraved both words and pictures on copper plates Catherine made the printing impressions hand-colored the pictures and bound the books Offered for a few shillings each the books sold slowly Today a copy is worth thousands of dollars

Blake's fame as an artist and engraver rests largely on a set of 21 copperplate etchings to illustrate the *Book of Job* in the Old Testament However he did much work for which other artists and engravers got the credit Blake was a poor businessman and he



This painting of The Infant Jesus Riding on a Lamb is typical of Blake's work as an artist.

preferred to work on subjects of his own choice rather than on those that publishers assigned him

Blake was a follower of Emanuel Swedenborg who offered a gentle and mystic interpretation of Christianity His poetry largely reflects Swedenborgian views *Songs of Innocence* (1789) shows life as it seems to innocent children *Songs of Experience* (1794) tells of a mature person's realization of pain and terror in the universe This book contains his famous *Tiger!* *Tiger!* *Burning Bright* Milton (1804-5) and *Jerusalem* (1804-20) are longer and more of serious works Blake died Aug 12 1807

BLEACHING Whitening a substance by taking out its natural coloring matter is called bleaching White cloth and paper and often sugar and flour are bleached during manufacture The housewife adds a bleach to her laundry water to help remove dirt and to restore whiteness to the fabrics Human hair can be lightened by bleaching Sunlight is the oldest known bleaching agent The ancient Hebrews and Egyptians wetted their fabrics and set them out in the sun to bleach In Ireland Scotland and Belgium fine linens are still bleached by this method

Chlorine compounds are the most important chemical bleaching agents Among those used are liquid chlorine chloride of lime sodium chlorate sodium hypochlorite (used in laundry bleaches) and calcium hypochlorite In solution these agents release oxygen and thus remove color by oxidation Hydrogen peroxide also bleaches by oxidation Sulfurous acid is used in bleaching wool works as a reducing agent

BLIGHT. When plants dry up and shrivel, or turn yellowish or brown, or when the fruit decays early, the plant doctor says that it is probably an attack of "blight." Very often this is caused by a mildew attacking the leaves, but it may be due to a poor supply of food and air at the roots.

Blights of grains are called "rusts" or "smuts," because they make the grain look reddish or black. Some other common blights are "scab" and "rot" of potatoes, "beet-root rot," "peach leaf curl," and "apple scab." (See Mildews and Molds; Rusts and Smuts.)

BLIND, EDUCATION OF. Blind, deaf, and dumb! Can you imagine a more pitiable plight for a two-year-old child? This was the situation of little Laura Bridgman, born at Hanover, N. H., in 1829; nevertheless, she became a cheerful, happy citizen, and did a great deal for the happiness of others. An attack of scarlet fever in 1831 left her completely shut out from the world, save for her sense of touch, and her life seemed completely blighted.

When she was eight years old, however, Dr. Samuel G. Howe, superintendent of the Perkins Institute for the Blind in Boston, undertook the untried task of developing a mind thus doubly barred. First the child was given a spoon and a fork on which were labels with the raised letters F-O-R-K and S-P-O-O-N. Gradually the connection dawned upon her, and when the labels were removed she could replace them on the proper articles. Then the letters were separated, and patiently she was taught to assemble them again so they would spell the words. This process was repeated with other articles, until finally she was familiar with the whole alphabet, and knew how to spell many names of simple objects.

Now she was ready to learn finger spelling. A raised letter would be given her, and, with Laura's delicate fingers "watching" closely, the deaf-and-dumb sign of that letter would be formed by the teacher. Soon she was "writing her thoughts on the air" with astonishing rapidity, and by feeling with her hands the signs made by the person conversing with her, she was soon "talking" with them. This education continued until she was 20 years old, and she developed into an unusually skilful teacher of blind children and was happily employed earning her own living until her death in 1889.

The Beginning of a New Era

Laura Bridgman did not have the brilliant mind of that other famous blind deaf-mute, Helen Keller, and did not achieve such spectacular results (see Keller, Helen). But Laura's education was a triumph, for it showed that the blind could be taught even when they were deaf-mutes. This was the greatest advance since the work of Valentine Haüy, "Father and Apostle of the Blind." Haüy, a teacher of penmanship in Paris,

had taken the first real steps to educate the blind. About 1784 he devised books with raised letters so that they could be deciphered by touch. He then opened a school for blind children. His book 'Education of the Blind' (1786) led Russia, Finland, and other nations to open similar schools.

Books for the blind now for the most part are not

a b c d e f g h i j k l m

n o p q r s t u v w x y z

• • • • • ! () ? • • • • •

• • • • •

You see how simple the Braille alphabet is—just a few little dots in various positions that to the sensitive fingers of the blind soon come to convey the precious message of books.

printed in raised letters, but in an alphabet of raised "points" so arranged as to represent the different letters. This method was invented in 1829 by Louis Braille, who became one of the best organizers in Paris and a noted educator of the blind. As a child he delighted to play in his father's saddlery shop, punching holes in the scraps of leather with an awl. One day the sharp tool slipped,

injuring his eye so severely that he became totally blind. He thought a great deal about the little marks the awl left in the leather, and the idea came that if the awl were punched only half way through, a dot would be raised on the other side. With this as a basis he worked out a system whereby different variations of groups of little raised dots represented letters of the alphabet, special word and syllable signs, and punctuation marks. Educators seized upon this system, and with modifications it is taught in every country where there are schools for the blind. To persons whose fingers are not sensitive, it seems as it did to the newly blinded soldier, who, running his finger over the page, exclaimed disgustedly, "Aw, it feels just like a sheet of sandpaper." But to thousands who have mastered its characters it has opened a new world of happiness.

The "American braille" and "New York point" alphabets formerly used have now given way to the Revised braille shown in the illustration above.

Typewriters have been invented for writing all these systems, and machines for embossing the characters on brass plates, so that any number of impressions may be printed.

Books for the Blind Are Costly

A large number of books and several magazines are printed in braille as well as in raised letters. Both kinds of books for the blind are much more expensive than printed books. Dickens' 'Old Curiosity Shop', which can be obtained at usual book prices, costs ten or twenty times as much in braille and is bound in six fat volumes. So most blind people have to depend on their school libraries, on public libraries in the larger cities which have collections of such books, and on state libraries which make the circulation of books for the blind a part of their work. The United States government aids the work by permitting such books to be sent through the mails under a "frank," that is, without postage.

The alphabet of raised Roman letters in combina-

tion with certain other characters is still valuable for those who are too old to learn the new method or whose fingers are not sensitive enough. The large letters make the books very bulky.

For writing braille by hand a grooved board is used with a perforated metal rule as a guide. The points are impressed on soft paper with a metal pencil. This is read from the raised side. Most schools for the blind teach the use of the braille typewriter and advanced students are taught how to use an ordinary typewriter. The 'touch' system now used by every trained typist, was originally devised for the blind. Special touch devices are used to teach other school subjects to the blind. Photoelectric scanning devices turn light into sounds so that the blind can 'hear' writing and printing. (See Photoelectric Devices.)

Under the Barden-LaFollette Act the Federal government offers rehabilitation aid to the blind. This is administered by the Office of Vocational Rehabilitation, includes every kind of help needed to make a blind person employable or capable of earning more money. The federal office works with state agencies to provide this aid. Public schools in larger communities provide special teachers for blind children.

Properly trained blind persons have entered many vocations. They practice law and osteopathic medicine. Many excel in music as performers or teachers. Others turn their musical skill to piano tuning. Blind people perform many different jobs in industry. They handle such machine tools as drills and punch presses and they are especially skilled at assembling and packing small manufactured items. Seeing eye dogs guide many blind persons as they move about indoors and outdoors (see Dogs).

BLOCKADE A blockade is a barrier. It stops people from entering or leaving a place. In warfare a blockade used to mean a naval patrol around an enemy's seaport that stopped all sea traffic. Today the word 'blockade' means any barrier to the passage of men, supplies or communications in or out of a country at war.

During the Civil War in the United States the Union naval forces set up a blockade around the Confederate seaports. The South could not receive shipments of food or munitions by sea, nor could it ship cotton to England, its best customer. Sometimes swift blockade-runners slipped past the Union naval patrol ships, but effective use of the blockade helped decide the final outcome of the war.

Use of the old time naval blockade was based on international laws arrived at in the Declaration of Paris in 1856 and the Declaration of London in 1909. These required that a blockade was to be formally declared and that it was not to extend beyond the enemy's coast lines. The laws were made to protect the rights of neutral nations who wanted to ship to any of the nations at war.

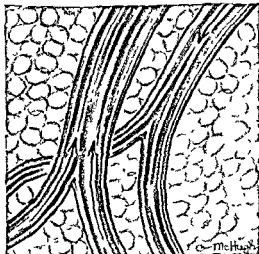
Naval blockades were used in both World Wars. In the second World War the Allies also used diplomatic and trade pressures to stop shipments at their source. They made trade agreements with neutral nations, required neutral ships to carry cargo-approval certificates ('navicerts') issued by Allied officials and refused business to those who traded with the Axis. Both sides used devious methods to smuggle critical war materials out of neutral nations and past the blockades. The most effective naval blockade was the one used by the United States against Japan (See also World War, First World War, Second).

BLOOD—The LIFE STREAM of the BODY

BLOOD The life fluid of our bodies is blood. It carries food and energy to all the body cells. Blood helps keep us warm. It carries away wastes and it fights off the constant attacks of disease and decay.

When blood stops flowing, life ends. If the blood supply to the brain stops for a few seconds, we faint. The airplane pilot leveling off after a power dive may 'black out' because the violent change of direction drains blood from his head.

In a real sense blood is a medicine. Sick, injured, or wounded people often need more blood than their bodies can make. A wounded soldier, for example, may need as many as 30 pints of additional blood during treatment. A healthy adult can donate a pint of blood every few months without harm because the healthy body soon rebuilds its own supply. Donating blood is safe, absolutely painless, and takes only a little time. The donated blood is held in any one of several forms until it is needed for use.



This drawing, made from a motion picture, shows the swift flow of blood through vessels. The vessel on the right is an artery and the one on the left is a vein. The light red streaks are deeper lying vessels. The background consists of tissue cells.

Blood donation is the duty of every healthy adult. In wartime vast supplies are needed. In peacetime there must be enough to treat the sick and injured and to build up emergency supplies. The person who gives blood has the deep satisfaction of knowing that he is helping to save another's life.

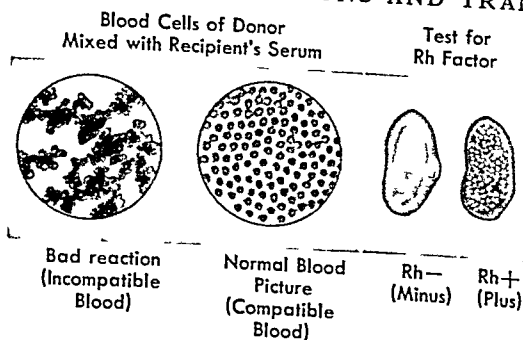
Blood normally makes up about $\frac{1}{3}$ of our total weight. Thus a man weighing 155 pounds has about 12 pounds of blood, or about $5\frac{1}{2}$ quarts. Blood is a mixture of liquid and solid particles. The most numerous particles are the *red corpuscles*, which give the blood its color.

There are about 300 million of them in a drop. The *white corpuscles* are larger; they number about one to every 700 of the red. For every 20 red corpuscles there is about one tiny *platelet*. The liquid which carries these particles, or cells, is called *plasma*.

The Work of the Blood Cells

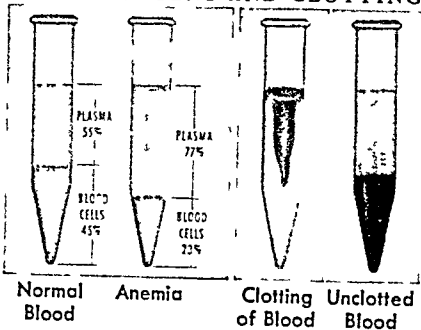
The red corpuscles are also called *erythrocytes* ("red cells"). Each red corpuscle is a sac, holding a substance called *hemoglobin*. This consists of *hematin*, which contains iron, and *globin*, a protein. The red corpuscles carry oxygen from the lungs to the tissues and cells. In the lungs the hemoglobin picks up oxygen. The *oxyhemoglobin* thus formed makes blood in the arteries bright red. As arterial blood moves to the capillaries, the corpuscles give up some oxygen. Losing oxygen darkens the blood. That is why veins (carrying venous blood) seen through the skin look blue. The oxygen passes through the capillary walls and is used by the cells. In exchange the cells give up carbon dioxide, and red corpuscles carry some of this waste back to the lungs.

BLOOD DONATIONS AND TRANSFUSIONS ARE SAFE, PAINLESS



Before a transfusion, a sample of the donor's blood cells are mixed with a sample of the recipient's serum. Under a microscope a bad reaction shows the cells forming into clumps; a good reaction looks like normal blood. Donor's and recipient's bloods are studied for the Rh factor, because Rh+ and Rh- bloods cannot be mixed. At the right, a donor is giving blood. The procedure is safe, painless, and takes only a little time. The inset (upper right) shows a blood shipment bottle, with a sample attached for testing.

BLOOD CONTENT AND CLOTTING



Normal and anemic blood have different cell counts. Anemia is also marked by lowered hemoglobin content. In air, normal blood produces fibrin that forms a net around the red corpuscles, preventing further flow from a wound. Without fibrin blood cannot clot by itself.

There are two chief kinds of white corpuscles. About 74 per cent are *leucocytes* and about 22 per cent are *lymphocytes*. The remainder are called *monocytes*. A leucocyte has a many-lobed nucleus. It is about one fourth larger than a red corpuscle. It moves independently and can even work its way through the capillary walls.

The leucocytes devour harmful bacteria. Because "eating" is their main job, they are sometimes called phagocytes (from the Greek *phago*, "I eat"). When bacteria enter tissue through a skin break, thousands of leucocytes come from nearby capillaries and attack them. Many leucocytes die but new ones move in. The accumulation of dead bacteria, leucocytes, blood, and dead cells is called "pus."

A lymphocyte is smaller than a leucocyte and has a bean-shaped nucleus. It helps repair tissues damaged when leucocytes and bacteria fight. Lymphocytes are made in the lymph nodes and other lymphatic tissue. Monocytes are phagocytic and are believed to help the leucocytes free the blood of foreign matter. They perhaps originate in the lymph nodes.

The blood's tiniest particles are the platelets. They are only one fifth to one tenth the diameter of red corpuscles. When platelets come in contact with air or any other foreign substance, they disintegrate, liberating a substance which helps blood to clot. The origin of platelets is unknown. They may be fragments of red corpuscles or they may be made independently in the red bone marrow.

Plasma, the Vital Liquid

The blood cells make up somewhat less than half the volume of blood. The rest is plasma. About 90 per



cent of plasma is water. Plasma aids in respiration by carrying both oxygen and carbon dioxide (see Respiration). It helps digestion by carrying digested food to the cells (see Digestion). Hormones and other glandular substances travel in plasma (see Hormones). Vaccines, antitoxins and sulfa-type blood antiseptics are carried by the plasma.

Plasma carries many nitrogen compounds such as amino acids, urea, and certain proteins such as albumin. It carries sugars, fats, and vital mineral salts. Plasma transports wastes and delivers excess foods to the liver and other storage regions. It supplies the sweat glands and the digestive glands.

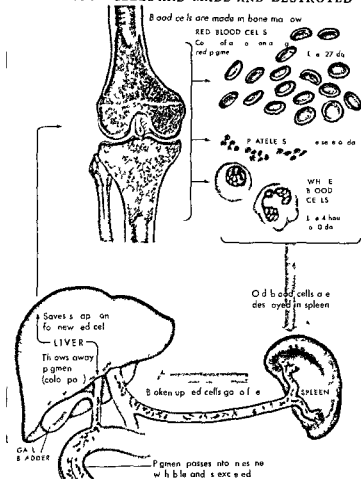
The chemical composition of plasma must remain almost constant. If the blood became more dilute, red corpuscles would swell and burst. If it became more concentrated, the red corpuscles would shrivel. Thus, water taken in by plasma from the intestines is balanced by what it gives up through the kidneys. All its exchanges are made through the capillary walls. (See also Kidneys, Liver, Lungs, Skin.)

Among the most active ingredients of plasma are substances called *globulins*, *prothrombin*, and *fibrinogen*. Globulins help maintain the viscosity of blood and also carry immunity against certain infections. Prothrombin and fibrinogen are clotting agents. When blood is exposed to air, these clotting agents form a threadlike substance called *fibrin*. Fibrin enmeshes the red corpuscles like a net and then shrinks to prevent further outflow of blood. A fluid called *serum* is pressed out as the fibrin shrinks. Serum is simply plasma from which fibrin is removed.

Lymph, the Blood's Helper

Closely allied to blood is lymph, a clear yellowish liquid which surrounds the body cells. By means of the lymph, cells get oxygen and food from blood and send waste products back to the blood. Lymph is made up of the parts of blood that seep through the capillary walls and surrounding tissues. It has no red corpuscles and contains much less protein than blood plasma. Lymph circulates constantly. After reaching the cells, it returns to the blood stream. It may pass back through the capillary walls or it may return through the *lymphatic system*. This consists of a network of vessels draining all parts of the body. It converges finally in the *thoracic duct* which discharges into

WHERE BLOOD CELLS ARE MADE AND DESTROYED



Here in the life cycle of the three types of blood cells iron is used over and over but it must be supplemented by iron from digested food. (Drawing by Gladys McHugh)

a large vein in the upper part of the chest. Pressure on the lymph vessel walls caused by breathing and other body activity keeps the lymph moving.

Along the lymph vessels lie enlargements called *lymph nodes*. The nodes filter out particles such as dust and soot which enter the lymph capillaries from the lungs. Bacteria that get into the lymphatic system are attacked by lymphocytes in the nodes.

The lymph also carries digested fats. These do not enter the blood directly. They pass first into special lymph vessels (the *lacteals*) in the small intestine and thence through the lymphatic system into the blood (see Physiology).

Blood and Temperature

Body heat is carried off by air coming out of the lungs and by radiation from the skin. To maintain normal body temperature in all kinds of weather, heat

loss must be regulated. In part this is done by the sweat glands (*see Skin*). Another part of the control is exercised through the capillaries. In the cold the temperature-regulating nerves cause the capillaries of the skin to contract. Thus less blood circulates near the skin and less heat is lost by radiation. In warm weather capillaries expand, increasing heat loss.

Blood Tests and Blood Deficiencies

Blood tests are widely used in medical diagnosis. They take into account the proportion of red and white cells and the chemical composition of the plasma. A simple *blood count* is made under a microscope. Red corpuscles in a standard sample of diluted blood are counted and the number per cubic millimeter is computed. About 5 million is normal. A *differential count* shows the proportion of the different types of corpuscles. The normal total for all white corpuscles is from 5,000 to 9,000 per cubic millimeter. Chemical tests determine the excess or deficiency of calcium, phosphorus, sugars, proteins, urea, uric acid, and cholesterol.

The measurement of the pressure of blood in the arteries is useful also in making diagnoses. A flat rubber bag, called a cuff, is wrapped around the patient's arm. The cuff is inflated to an air pressure sufficient to match the pressure of blood in the large artery of the arm. The pressure is read from a mercury manometer connected with the cuff. Pressure exerted when the heart is contracting is the *systolic pressure*; the lower pressure, when the heart is relaxing, is the *diastolic pressure*. (*See also Heart*.)

The usual systolic pressure in babies and children is 75 to 90 millimeters of mercury; in young adults, 100 to 130 millimeters; and in older persons, 130 to 150 millimeters. Diastolic pressure is usually from 30 to 50 millimeters below the systolic pressure. Blood pressure changes in emotional situations.

Anemia is the general name for deficiencies in the number of red corpuscles or in the amount of hemoglobin they contain. Some anemias are the result of faulty diets. Others, as pernicious anemia, are deep-seated diseases. An increase in the number of white cells usually takes place whenever infections occur in the body. This is a normal response to bacterial invasion and it helps physicians diagnose diseases due to infection.

In *hemophilia* the blood does not clot sufficiently to stop bleeding, and minor wounds, bumps, or bruises may prove fatal. It occurs only in men and is inherited only through women. The sons of a hemophilic father will be normal, but the daughters, without showing the disorder, may hand it on to their sons.

Blood Types and Transfusions

Human blood has sharply different types or groups. One classification recognizes four types, called A, B, AB, and O. Persons of the same blood type can exchange blood safely. Where blood types differ, the following rules apply:

People of types A or B can receive blood from those of type O and give blood to those of type AB; but persons of these first two types cannot exchange blood.

Those of type AB can receive from persons of all other types (universal receivers), but can give to none outside their own group.

Those of type O can receive from no other groups, but can give to all others (universal donors).

The wrong type of blood entering a person's circulation immediately *agglutinates*. Its red corpuscles clump together, forming tiny clots which block the capillaries. This is believed to be caused by the reaction of certain complex substances in the plasma of the receiver (*agglutinins*) and corresponding substances in the red cells of the incoming blood (*agglutinogens*). The blood of universal receivers (type AB) lacks agglutinins and has no effect on incoming blood. The blood of universal donors (type O) lacks *agglutinogens* and is not affected by agglutinins in the receiver's blood.

Blood plasma, from which all red corpuscles have been removed, is often adequate for transfusions and does away with the problem of matching blood types. Whole blood for transfusion may be kept in refrigerated *blood banks* for several weeks; liquid plasma, for several years. Dried plasma may be kept indefinitely without refrigeration and needs only the addition of sterile water.

The Rhesus, or Rh, factor was first studied in the blood of Rhesus monkeys. If people have this factor, they are Rh positive. If not, they are Rh negative. If an Rh negative person is given an Rh positive blood transfusion, his blood develops *antibodies* to fight the contrasting factor. More Rh positive transfusions may cause illness and even death. The unborn child of an Rh positive father and an Rh negative mother will probably develop Rh positive blood. There is no direct connection between the mother's bloodstream and that of her unborn child. However, anti-Rh substances manufactured by the Rh negative mother get into the unborn child's Rh positive bloodstream. This causes severe, possibly fatal, illness in the child.

How Blood Circulation Was Discovered

The ancients believed that the arteries contained air and only the veins had blood. The Greek physician Claudius Galen, in the 2d century A.D., demonstrated that both arteries and veins contain blood. He thought the blood went out and back in the arteries—a kind of ebb and flow—and similarly for the veins but with a different kind of blood. A direct connection between arteries and veins was not thought of for many centuries.

In 1628 Dr. William Harvey, a London physician and teacher, published a book in which he showed that veins carry blood to the heart and the heart pumps the blood into the aorta and the arteries. He did not actually discover the minute capillaries which connect arteries and veins. These were found by the Italian, Marcello Malpighi, in 1661, and by the Netherlander, Anthony van Leeuwenhoek, in 1669, with their newly invented microscopes. Students in science classes can study capillaries in the webbing between the toes of a live frog. The microscope shows them how blood corpuscles move through the capillaries.

BLOODROOT One of the loveliest but most fragile flowers of early spring is the bloodroot. In April and May it pushes its delicate white blossom upward wrapped in silver green leaves in open woodlands from Canada to Florida and west to Nebraska and Arkansas. The first warm sunshine opens the flower with its yellow stamens and from 8 to 12 white petals but rain or wind soon blows the petals away.

The plant is named for the red juice which oozes from broken stems and roots. In older days it was taken on a lump of sugar to cure coughs and colds. The dried roots (called sanguinaria) contain an alkaloid (sanguinarin) which has medicinal value as an emetic, purge and stimulant. American Indians used the juice to dye grasses and quills and for war paint.

The two-inch blossoms grow on plants about eight inches high. The bloodroot is a perennial of the poppy family. Its scientific name is *Sanguinaria canadensis*. (For picture in color see Flowers.)

BLUEBELL We often hear about the bluebells of Scotland. These flowers however grow in many other lands. They are common in the well watered parts of Canada and the United States from coast to coast.

Bluebells are named for the plant's bell-shaped blossoms. The flowers are not always blue. Some kinds are violet, purple or white. The tall slender stems grow from a few inches high to several feet. The leaves are narrow and lance-like. The plants grow year after year in shaded, moist areas and also upon many mountains. They bloom from June to September.

Bluebells belong to the genus *Campanula* (in Latin, little bell) which includes about 250 species. The bluebell of Scotland is also called the harebell (*Campanula rotundifolia*). The tall bellflower (*Campanula americana*) is a more southerly species found from Canada south to Arkansas and Florida. The most popular garden species is the Canterbury bell (*Campanula medium*). In the United States the name bluebell is also applied to the Virginia cowslip or lungwort (*Mertensia virginica*). (For illustrations in color of the bluebell and of the Virginia cowslip see Flowers.)

BLUEBERRY Like the cranberry the blueberry is nature's free gift. Our chief market supply of this delicious fruit comes from extensive patches of wild bushes in scattered areas of Canada and the United States. Attempts to cultivate the blueberry failed until scientists discovered that in its wild state it is always associated with a nitrogen-gathering fungus which grows on its roots. This fungus thrives best in an acid soil composed of peat and sand. Most blueberries produce their fruit in clusters but the mountain blueberry and the related plants of Europe and Asia bear the fruit singly. All cultivated blueberries are hybrids of the highbush species developed since 1906 by Frederick V. Coville, chief botanist of the United States Department of Agriculture and Elizabeth C. White of New Jersey. New Jersey has the largest acreage.

Six species of wild blueberries are marketed commercially. The most important is the lowbush

(*Vaccinium angustifolium*) which grows from Maine to Minnesota and southward in the Alleghenies to West Virginia. The blueberry barrens of Maine cover an area of about 150,000 acres. The highbush blueberry (*V. corymbosum*) 10 to 15 feet in height grows from Maine to Michigan and south through Georgia. The dryland blueberry or low blueberry (*V. pallidum*) one to two feet high is important in northern Alabama, Georgia, Maryland and West Virginia. The Pacific coast has the evergreen blueberry (*V. ovatum*). The branches are shipped east to be sold for decorative purposes under the name of evergreen huckleberry. The mountain blueberry (*V. membranaceum*) grows chiefly on the high slopes of the Cascades. The rabbiteye blueberry (*V. virgatum*) is the chief commercial species of the southeastern states.

The name huckleberry is properly applied to the related genus *Gaylussacia*. Both are members of the heath family *Ericaceae*. True huckleberries are more acid than blueberries and are shiny black. In Europe the blueberry *V. myrtillus* is called the herry or whortleberry. In America whortleberry is another term for huckleberry.

BLUEBIRD One of the earliest voices of the northern spring is the bluebird's sweet plaintive warble. In spite of its sad little song, this brilliantly colored bird is the symbol of happiness. Like its namesake in Maeterlinck's story, it is found in common places seeking the companionship of man in fields, orchards and gardens.

The nest is always placed in some cavity—a hollow apple tree, abandoned woodpecker hole, rotted fence post, bird box, even in rural mailboxes. The bottom is lined with dry grasses on which the female lays four to six bluish white eggs. A wise farmer pro-

BLUEBIRD AT A NESTING BOX



This bluebird is bringing a large insect in its bill to feed the young in the box. Bluebirds have learned to prefer a well built nesting box like this one to the natural homes in a hollow tree, abandoned woodpecker nest, or rotten fence post.

fects bluebirds, because in summer they eat harmful insects. In winter they eat wild berry seeds. (For pictures in color, see *Birds; Egg.*)

Bluebirds belong to the thrush family *Turdidae*. The scientific name of the eastern, or common, bluebird is *Sialia sialis sialis*; length, 7 inches; upper parts bright blue, tipped with rust in fall; throat, breast, and sides, chestnut; female, grayish blue, underparts paler than male; range, east of Rockies, Labrador to Florida; winters from middle states to Gulf. It is the state bird of Missouri (official) and New York (unofficial).

The mountain, or Arctic, bluebird is *S. currucoides*; length, $7\frac{1}{4}$ inches; cerulean blue; female, brownish gray with blue wings and tail; range, mountains of western North America; winters in southern United States and Mexico. It is the state bird of Idaho and Nevada.

The western bluebird is *S. mexicana occidentalis*; length, 7 inches; upper parts purplish blue and chestnut, underparts chestnut; it ranges from western Nevada and Idaho to the Pacific coast and north to British Columbia; it winters in Mexico.



In spring, these blue wild flowers color the Texas plains. The bluebonnet is the official state flower of Texas, where it is abundant.

BLUEBONNET. The graceful bluebonnet is the state flower of Texas. In March, after the early rains, it spreads wide carpets of blue across the central and southern prairies of the state.

The bluebonnet gets its name from its small flowers. They grow in a loose cluster on a foot-high stem and look like tiny blue sunbonnets of the kind pioneer women wore. The blossom has a spot of red where four of the five petals come together. The seeds grow in wiry pods. When the pods are ripe, they spring open and scatter seed.

The bluebonnet is one of the lupines and belongs to the pod-bearing family (*Leguminosae*). The scientific name is *Lupinus subcaruosus*. Resembling it, and considered the same flower by many botanists, is the *Lupinus texensis*, also of Texas.

BLUEPRINT. Copying architectural and engineering drawings once required hours of tedious work. Blueprinting, which came into use about 1876, made it possible to get copies within a few minutes.

Blueprint paper is a tough, white paper made sensitive to light by a solution of iron salts. A drawing inked on translucent paper or cloth is held tightly against a piece of blueprint paper and exposed to light. Light passing through the drawing turns the sensitized paper blue except where the lines of the drawing block it. After exposure the blueprint paper is washed in clear water, and the plans appear as white lines on blue. Sir John Herschel discovered this process in 1840.

Other methods are also used to reproduce drawings. *Vandyke prints*, which must be fixed in hypo, have a brown background tone. Positive prints, with dark lines on a white ground, are made on special positive paper; they can also be made on ordinary blueprint paper by using a blueprint or Vandyke as the "original." *Positive Ozalid prints* are made directly from a drawing and are developed in ammonia vapor.

BOA CONSTRICTOR. Often the name "boa constrictor" is loosely applied to any large serpent that crushes its prey in its powerful coils. The name, however, properly belongs to two snakes which are native to tropical South America, the true boa constrictor and the anaconda. The former lives in dry bushy regions and the latter in swampy places. Both differ from the pythons, which live in the tropical regions of the Old World.

The boa constrictor sometimes attains a length of 12 feet and the anaconda a length of 30 feet. The boas have no poison fangs, but their powers of crushing are great. They can swallow whole animals as large as a small dog. After feeding they remain torpid for several weeks to complete the process of digestion. During this period they are easily captured or killed. (For picture, see *Snakes.*)

BOAR. Hunting this ferocious species of wild swine was once a favorite sport of Europe's kings and nobles. A special breed of dogs (boarhounds) was developed for it. During their long rule in India, the British hunted a similar beast from horseback with lances. They called the sport "pigsticking."

The wild boar of Europe is about four feet long and is covered with bristles and grayish-black hair. It is larger than most breeds of the domestic hog, and its formidable tusks and savage spirit make it a dangerous foe when brought to bay. In a fully grown male, the great tusks of the lower jaw curve over the snout and are useless. Then the boar uses the protruding teeth of the upper jaw as weapons. Boars live in the forest and wander about at night to feed on roots, herbs, and grains. They will also eat small animals when they can.

A FIERCE FIGHTER



For many centuries the wild boar of Europe provided exciting and dangerous hunting for kings and nobles. With its teeth and tusks it could slash men or dogs if they ventured within reach. Boar hunting is still a popular sport in some parts of the world.

Scientific name of European wild boar *Sus scrofa*. It is found in Europe, northern Africa and central and northern Asia, is fairly plentiful in Spain, Russia and Germany but is extinct in England. The Indian wild boar *Sus cristatus* is slightly taller than the European. The peccary of Texas and Mexico is much smaller. It was the only wild hog in North America when the white men came.

BOARDS OF TRADE

A large floor is crowded with men who are shouting and signaling with their fingers. Messenger boys dodge through the throng. Such is the usual scene in the grain exchanges where the nation's grain crops are marketed.

A grain exchange—called Board of Trade in Chicago Chamber of Commerce in Minneapolis and by other names elsewhere—is a special market place. Only a member of the exchange can trade upon its floor, but anyone who wishes to buy or sell can give his order to a member. The member acts as a broker and charges a fee called *brokerage* for the service.

Trading is done in different pits for the various grains. Offers to buy or sell are made largely by hand signals. A trader offers to buy by holding up his hand palm toward himself and moving it in. He offers to sell by holding the palm outward and moving it toward other traders.

The amount of grain and price are shown by finger signals. One finger held vertically means 5,000 bushels. All five fingers mean 25,000 bushels. To show price, a trader turns his hand horizontally and gives one of the price signals shown in the picture on this page. Since every trader knows the price to the nearest cent, only the fractions need be shown by signal.

When another trader is willing to take the offer, he nods across the pit. Then the two traders note the transaction on their trading cards. If any additional information is needed, traders call it out. After trading in the pits ends for the day, every transaction noted on the trading cards is faithfully fulfilled, even though fortunes may be lost.

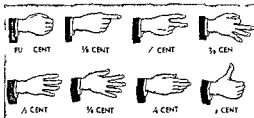
The price quotations in all leading exchanges are immediately telegraphed everywhere. If the price difference between two markets should become greater than the cost of transportation between them, traders will buy in the low price market and at the same time sell equal quantities in the high price one. This process, called *arbitrating*, keeps grain prices reasonably equalized all over the world except when tariffs or other restrictions interfere.

Sales of grain for immediate delivery are called *spot sales*, and the grain is *cash grain*. A more

THE NATION'S GREATEST GRAIN MARKET



Here is a pit on the Chicago Board of Trade. Traders in the pit buy and sell contracts called futures for delivery of grain at later dates. New orders and notices of trades flow between the broker's office and the pit through a battery of telephone operators (foreground). At one edge of the pit, observe a note every 15 seconds change and send news of the ticker to the graph.



Grain is delivered by the bushels of a cent a bushel. Traders use these finger signals to show the bushels at which they will buy or sell.



Here a cash trader examines a sample from a barrel of grain in Chicago during sale. If he buys, his office pays and ownership passes before the end of the day. A trader's lot in future must be balanced off by delivery of grain through such cash sales.

specialized activity is trading in *futures*. A "future" is a contract to accept or deliver grain during some specified month. The seller usually does not possess the grain he contracts to deliver, but expects to buy it at a lower price before the time of delivery. An example will make clear the nature and value of such trading.

Suppose that in June demand for wheat is normal, and good crops are in sight. During July, new winter wheat will enter the market (*see* Wheat); this should cause lower prices. In June, therefore, traders will sell "July wheat"—that is, agree to deliver wheat in July—for less than the June cash price. If, however, conditions indicate that prices will go up in July, traders will demand an advance upon June prices for July wheat.

A trader who buys under this arrangement is said to be "long July wheat." The seller is "short July" until he "covers his trade" by purchasing the grain. If the price goes lower, as he expects, he makes a profit; if the price goes up, he loses, since he must deliver the grain, regardless of cost. Therefore he is *speculating*, or accepting a risk in order to profit if he has judged price trends correctly.

Usually the trader furnishes a certain percentage, called *margin*, of the money required; the broker supplies the rest. If the price goes down, the broker "closes out" the trade before any of his money is lost, and the trader loses his margin money. But if the price goes up, the trader gets a large percentage of profit, since he gets the profit after having supplied only part of the money required. Traders who operate in expectation of rising prices are called *bulls*; those who expect falling prices are *bears*.

Futures contracts are paid for when they are made, not when the grain is delivered. Therefore a farmer can sell wheat and get the money, if he likes, even before the wheat is grown. Flour millers also can buy a season's supply of wheat whenever they think prices are favorable; but they benefit even more by being able to *hedge* their purchases of wheat.

Whenever a flour miller buys wheat, he hedges the purchase by selling an equal amount in the futures market. If thereafter the price goes up, he loses on his futures, or short, sale; but he gains equally from the increased value of the wheat he owns. Lower prices make his wheat worth less; but the loss is balanced by his profit from the short sale. As rapidly as the wheat is milled, he "removes his hedges" by fulfilling his futures contracts. Thus he transfers all risk of loss to the professional speculators, who make a business of assuming these risks.

Exchanges also are maintained for spot sales and futures trading in wool, cotton, rubber, coffee, sugar, butter, eggs, silver, and other commodities. These exchanges perform useful services, but they have been subject to abuses. False prices have been established by "wash sales"—sales made by one broker to another who is acting for the same trader. Another abuse is *cornering the market*, that is, buying up all the existing supply for some contract month. Then traders who are "caught short" must pay the speculator anything he asks, to get the grain they need to fulfill their contracts. To prevent such abuses, the United States in 1936 established a Commodity Exchange Administration which had power to regulate trading. Later it was reorganized as the Commodity Exchange Authority, under the secretary of agriculture.

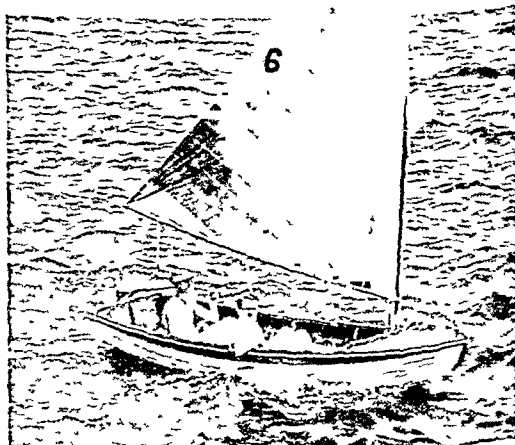
The LURE of BOATS and BOATING

BOATS AND BOATING. Thousands of years ago men discovered that they could use a log to support their weight on water and thus cross the rivers and lakes that lay in their way. Soon they found that they could support themselves better by making a raft of several logs. Then by degrees they learned to hollow out single logs to form crude canoes and to harness the wind with sails.

Nobody knows when or where these first steps were taken. We only know that as far back as we can trace the story, men had boats of some sort. The first white men in America found the Indians paddling their graceful birchbark canoes up and down the streams. Much of the pioneers' exploring was done by the aid of such canoes—so light that the travelers could carry them long distances over the rough trails or "portages" that separated one river or lake from another. (*See* Canoes and Canoeing.)

Boats differ from canoes chiefly in being more sturdily constructed and consequently heavier. Several types of craft are classified as boats: the small rowboat propelled by oars; the flat-bottomed punt propelled by a

This is a dinghy—a small catboat usually carried aboard larger craft as a tender. Dinghy racing is popular sport.



pole thrust against the bottom of a shallow stream the fisherman's heavy dory the lifeboats of ocean liners the houseboat the scow used for hauling sand and other materials and the narrow racing shell

Rowing Contests

The needle-shaped racing shell is constructed almost solely for speed. An eight-man shell is about 62 feet long and 2 feet wide. It is planked with cedar little more than an eighth of an inch thick and weighs somewhat less than 300 pounds. The hull has outriggers which support the rowlocks and sliding seats for the oarsmen. Oars are of two types. *Sweep*s are about 12 feet long and *sculls* about 9¼ feet. Both are made of tough spruce wood.

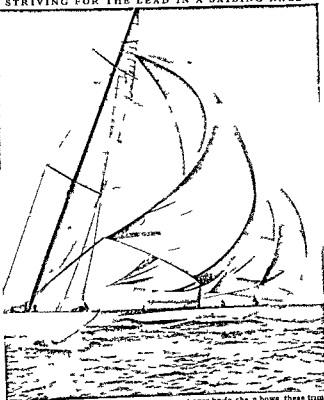
In sweep-rowing each man of the crew handles but one oar whereas in sculling each man handles two. In single sculling matches each man rows for himself. The most popular form of competition is eight-man sweep-rowing.

The crewmen of an eight are numbered successively from bow to stern. The number one man however is called the bow oar and number eight the stroke oar. The coxswain who steers and gives boat-handling orders to the crew sits in the stern facing forward. The stroke oar has the greatest responsibility for winning a race. He sets the beat (timing) of the rowing. This is usually between 30 and 40 strokes a minute. One other member of the crew acts as captain but he has no special responsibilities afloat. Crewmen are always powerfully built men because of the great strength and stamina required in competitive rowing. The average weight of crew members is often more than 175 pounds. The coxswain however is always light and preferably weigh no more than 115 pounds.

The most famous rowing matches in the world are those of England and North America. The Henley Regatta on the Thames River in England is one of the oldest regattas. One of its events is the famous Diamond Sculls. Other well known matches are those of the Oxford Cambridge Regatta, Royal Canadian Henley Regatta, Yale-Harvard Regatta, Poughkeepsie Regatta and the International Olympic Games. In some places lifeboat and whaleboat races are also held yearly.

In the United States collegiate rowing is largely concentrated on the east coast but some mid western and western colleges have fine crews. Certain eastern preparatory schools also develop good crews. At times they have defeated college crews over short courses. In recent years a number of public high schools situated near water have taken up rowing. Some women's colleges also make rowing a regular part of their athletic program.

STRIVING FOR THE LEAD IN A SAILING RACE



With snowy parachute spinnakers blowing out over knife sharp bows these trim racing sloops are using every device known to gain utmost speed.

Many people find that rowing an ordinary rowboat gives them pleasant and healthful exercise. Almost every beginner however makes the mistake of letting his arms do all the work of rowing. Instead he should get the power of his back and legs into the stroke. To begin the rower leans forward with back straight, arms extended and feet firmly braced. He then drops the blades of the oars smoothly into the water and leans back with them still keeping his arms straight. Back and legs supply all the drive during this part of the stroke. Toward the end of the stroke when he has leaned back as far as possible he uses his arms to pull the oars close to his body.

As the blades come out of the water at the end of the stroke a good rower feathers his oars (provided they are not fixed by the rowlocks). He does so by pushing the wrists down and forward. This turns the blades parallel to the water, cutting down their resistance to the air.

Sailing Is a Lively Sport

Sailing is not so vigorous a sport as rowing but it is one of the most delightful forms of boating. On American waters races are held for boats of all classes from little sailing dinghies to great J-class sloops. Among the most popular small boat classes are the Snipes (15½ feet) and Star boats (22 feet).

The America's Cup race has been the most famous yachting contest in the world since 1851, when the schooner-yacht *America* won the cup in a 60-mile race around the Isle of Wight. Between 1870 and 1937, American yachts won from 16 British challengers sent over to take back the trophy. Sir Thomas Lipton failed in five races with his *Shamrock* boats.

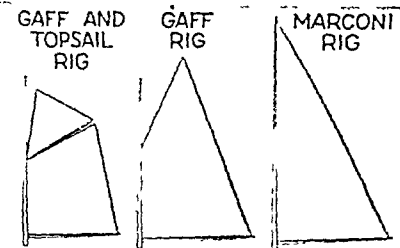
The sloop, or one-masted boat, is the favorite type for yacht racing. The catboat, the most popular craft for amateurs, is a small sloop without a jib. For cruising, yachtsmen favor two-masted craft, which may be schooners, yawls, or ketches. The drawings on this page show the rigs of these different boats.

Hulls vary with the purpose of the boat and the waters it is intended to sail. On small inland lakes, for example, a flat hull with a deep centerboard or thin keel is commonly used. On the Great Lakes and the ocean, it is necessary to have a deeper hull and a weighted keel if the ship is to be seaworthy when waves roll high. Often a motor and propeller are provided, powerful enough to drive the craft a few miles an hour in case of calm.

The most technical problem in sailing is handling the sails to take advantage of the wind. The simplest sail action occurs when a sail is spread so that it is driven square before the wind. But suppose a wind from the north is blowing upon a boat headed west.

going more than a little to the southward (the amount it does go is called "leeway"); but the water offers little resistance to westward movement, so the boat slips along readily in that direction. The exact set of sail and rudder needed to accomplish this movement will vary with the design of the vessel and other factors. Common applications of this principle to sailing, and some of the technical terms used, are given in the accompanying diagram.

CRUISING AND RACING RIGS



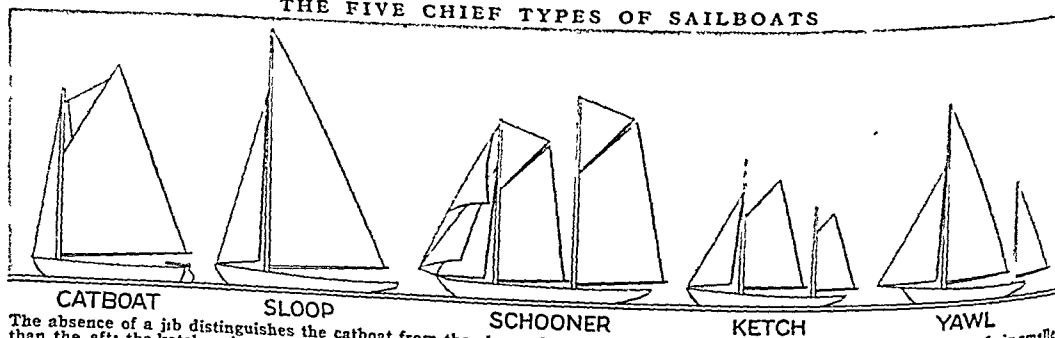
Each of these rigs has the same area of sail. The gaff-and-topsail rig is the steadiest; the Marconi, with its high reach, is best for racing; the gaff rig is a happy medium. As the drawings indicate, the "gaff" is the spar at the top of the mainsail.

The handling of sails may be understood from considering the "leg-o'-mutton," or triangular sail used on many sloops. The vertical forward edge of the sail is fastened to hoops, which slide up the mast as the tip is drawn upward by a halyard. The bottom edge is fastened to a boom or horizontal spar, so attached at its forward end that it can swing from side to side about the mast, swinging the sail with it much as a door turns on its hinges. The other end is fastened

by block and tackle to a convenient mounting on the deck, so it can be let out ("paid out") to either side, or hauled close in to the center line, as the yachtsman desires. A jib (the triangular sail before the mast), is handled similarly, save that it has no boom, and the hoops on which it runs are mounted on the forestay, the cable from the tip of the mast to the bow.

Every large sail bears on each side one or more horizontal rows of short lengths of cord, called "reef

THE FIVE CHIEF TYPES OF SAILBOATS



The absence of a jib distinguishes the catboat from the sloop; the schooner has two or more masts, with the forward rig smaller than the aft; the ketch and yawl reverse this order, the latter carrying its smaller rig (jigger) aft of the rudder post, the former forward of the post. The sails of any of these craft may be, according to taste, of the gaff or Marconi shape.

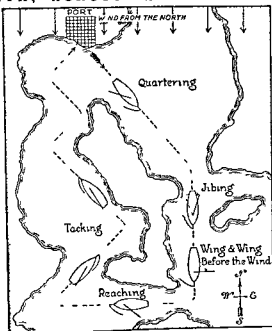
If the boat's sail were in line with the hull, so that everything was "broadside on" to the wind, the wind would press the boat and sail sidewise to the southward. To sail westward, the sail must be set to extend approximately southeastward from the mast. The wind now will exert a glancing pressure upon the sail, tending to force it southwestward. This southwestward pressure can be considered as operating in two directions—southward with the wind, and westward, the direction in which the boat is headed. Water resistance against the side of the hull keeps the boat from

points." If, owing to high wind, the yachtsman does not want to hoist his entire sail, he hoists as much as desired, then by tying reef points from each side firmly under the boom, he lashes down the unexposed portion of the sail. Because the sails of "square-rigged" ships were attached to spars high above deck, the crew had to go aloft to reef sail, instead of being able to do so from the deck, as they can on craft with "fore-and-aft" rig. (See Ships.)

In recent years gasoline motorboats have won ever increasing favor. While they do not offer the challenge

SAILING WITH, ACROSS AND AGAINST THE WIND

As an example of sailing with fore-and-aft rig let us follow this sloop as she goes from her home port (at the top of the picture) around the island and returns home. With this rig the mainsail tends to turn the bow around and into the wind and good sailing is largely a matter of using the jib to counteract this tendency as we shall see. At first the sloop quarters or takes the wind from between aback and abeam. It also stands on the port tack—that is, takes the wind over the port or left side. The mainsail is set as explained in the text and the jib is slackened off enough to keep the bow from turning. When he has to turn due south the yachtman jibes the mainsail or hauls it across from starboard to port and slackens off the jib to starboard. Now the sloop is sailing wing and wing before the wind. On large yachts a parachute-like spinnaker may replace the jib in this situation. When the time comes to sail west the yachtman puts the sloop on the starboard tack by hauling in somewhat on the mainsail and throwing the jib over to port



Now the sloop is reaching on a beam wind. Finally the yachtman must head north against the wind. This is called beating to windward. He decides to come about and head nearly northeast for his first beat or tack. He does so by luffing or steering into the wind and holding the rudder over until the sloop's momentum carries the bow through the wind. As the bow starts to fall off or turn with the wind the sails fill on the port tack. Now the yachtman may close-haul his sails to head as nearly into the wind as he can without putting the sloop in stays or causing it to be taken aback by the wind. But such sailing is slow so the yachtman will sail more nearly across the wind to gain speed. His skill and the shape

of the sloop's hull will determine where to strike the balance between gaining speed and making northward progress. In time to avoid overstanding or going too far east he will come about on the other tack. By repeating again and again this zigzag maneuver called tacking he finally reaches his home anchorage.

to skill presented by a sailing vessel they are less dependent upon weather, and easier to handle on narrow waters such as rivers. They range in size from launches no larger than a rowboat to palatial yachts (usually driven by Diesel engines) able to accommodate scores of people on a transatlantic voyage (See Diesel Engine, Motor Boats).

Such boats are classified broadly according to the type of hull and the engine location. The traditional hull is the 'displacement' type which has a prow that cuts through the water, and always sits low enough to displace its own weight. For achieving high speed on relatively calm water the 'hydroplane' hull is widely used. The hull is flat bottomed with or without 'steps.' At high speed the forward portion rises clear of the water, and the craft skims over the surface, riding on the 'heel' of the hull. Owing to the ease with which it captures only skilled drivers can handle this type of vessel at high speeds.

Motor boats are further classified as 'inboard' or 'outboard.' An inboard boat has the engine inside the hull connected by a shaft to the propeller. An 'outboard' has the engine and propeller in one unit hung overside from the stern, leaving the interior of

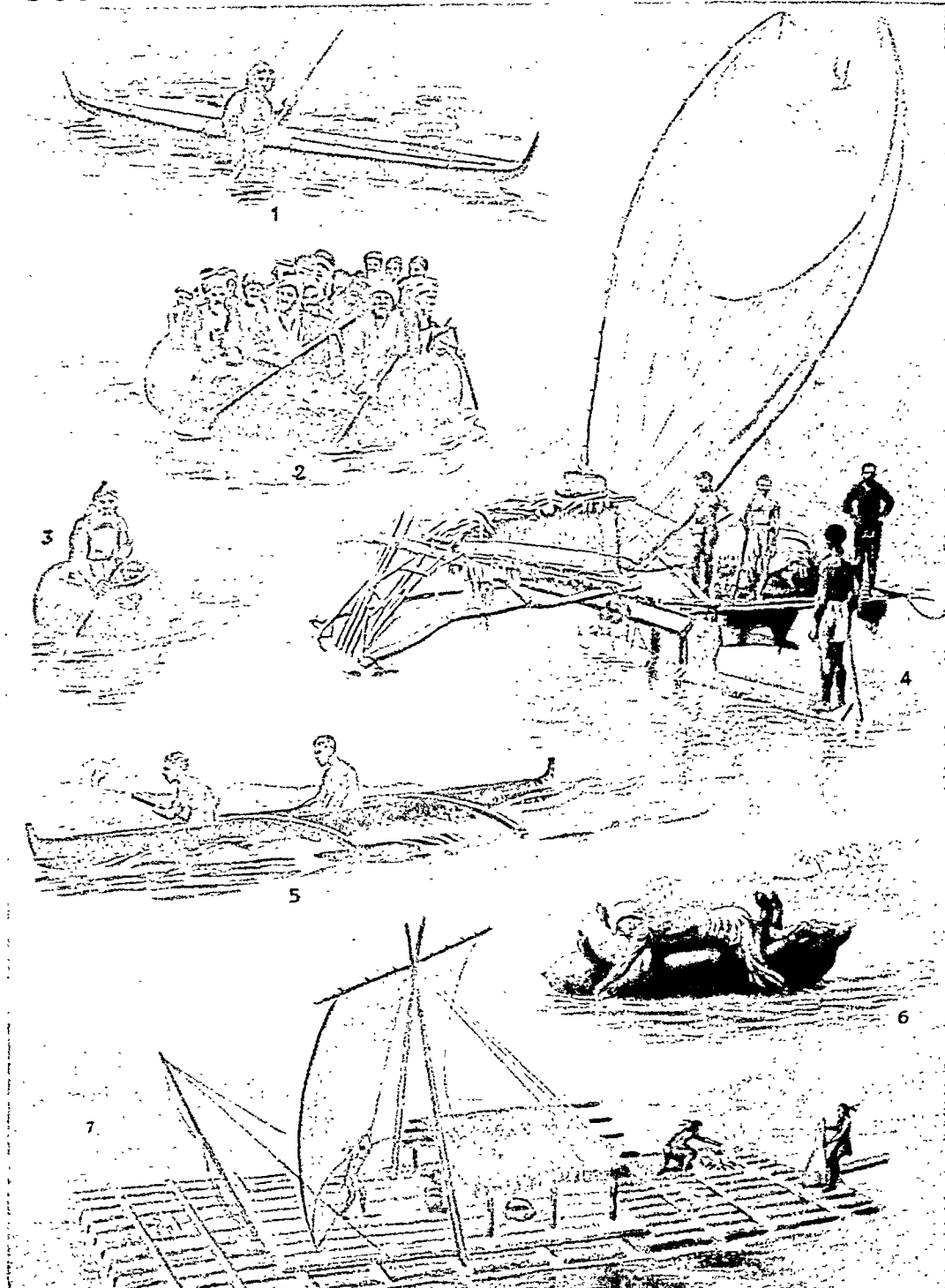
the craft free for the occupants. Rowboats can be made into motor boats by attaching an outboard motor and can be used in extremely shallow water since the engine is pivoted on its mounting and can be swung up to clear obstructions. Outboard motors are suited only to smaller craft. Larger ones must have their motors mounted further forward not only because of the greater weight but also because the powerful action of the propeller has a tendency to force the stern of the boat down into the water.

Ancestors of Modern Craft

One of the most curious of primitive boats was the round 'coracle' which Caesar found in use when the Romans invaded Britain and which is still used in certain lakes of Ireland and by Welsh fishermen. It is an open saucer-shaped vessel usually large enough for one man only. A skin or other waterproof covering is stretched and fastened over a frame made of thin strips of wood laid across one another, tied together, and bent upward.

A boat similar to the coracle is the 'goofah,' a circular basket-like craft woven of willow twigs and smeared with bitumen in which some say Moses was set adrift. It is still used on the Tigris and Euphrates

SOME PRIMITIVE TYPES OF WATER CRAFT



One of the most extraordinary craft ever built is the canoe (4) used in the Santa Cruz Islands, a group near the Solomon Islands. It has a long platform erected at right angles to the dugout with a living-house at the end supported by the outrigger. Other strange craft shown above are (1) an Eskimo kayak; (2) a goofah, used on the Tigris; (3) a coracle, such as the early Britons used; (5) a catamaran with an outrigger; (6) an inflated bull's hide, used by the natives of India for crossing rivers; (7) a balsa, or large raft, used by natives on the coasts and rivers of South America.

The round, clumsy looking 'bullboat' of the Sioux Indians was also of this type. It was built by stretching a buffalo hide over a framework of saplings and boughs. After it had done its work of carrying the Plains Indians and their belongings across a stream, the buffalo hide was frequently pulled off the frame and used as a container for utensils to be carried on a travois for overland transportation.

Catamarans and Proas

Off the coast of India and elsewhere natives use a primitive craft, called a 'catamaran' made of three logs lashed together. The middle log is longer than the other two and is pointed to form the prow. The rower kneels on this middle log and propels the boat with a paddle. This simple catamaran will safely ride the roughest seas. Another form of catamaran is that illustrated on the preceding page. It is a swift canoe with an outrigger attached to one side to prevent capsizing. This outrigger, as the picture shows, is formed of two spars, to the ends of which is attached a boat-shaped floating spar.

Among the best of primitive boats is the Malay proa, or prau. It has a sail to make it swift and an outrigger to make it safe. A typical proa is a long narrow canoe pointed at both ends so that it can reverse its direction without turning. One of its sides is flat, the other, curved. From the curved side projects the outrigger. The lateen sail, triangular in shape, is supported by a mast that rises from a point midway between the ends of the boat. It was in these swift proas that Malay pirates used to dart out from inlets and attack passing ships. (For a list of sailing terms see the entry Navigation, in the FACT-INDEX.)

BOBOLINK. The bobolink leads a double life. In the South it is considered an enemy of the rice crop. But the North loves it for its beautiful song and because it eats insects and weed seeds. The males even change their dress to suit their double life. In the North a male bobolink has black underparts and a white and buff back with bold marks. (For illustration in color, see Birds.) But all winter long he wears the sparrow-like dress of the female.

Every spring the bobolinks come north to rear their young. They build nests of grass and dried weed stems in some slight hollow in the ground. The female lays from four to seven eggs of grayish color with splotches of brown or purple. The birds take great care not to show where the nest is. They never fly

directly to it or away from it. The male never sings near it. He flits about, diving into the grass, then perches on a grass stem or clover top. There he sings the rollicking 'bob-o-link!' that gives the bird its name.

By July the young have learned how to get along for themselves. The male stops singing, and the ends of his gay spring feathers wear off. This exposes his winter dress. In August or September the birds start south in great flocks to spend the winter in eastern South America. On the way they raid the rice fields in the southern states. There they are called rice birds, reedbirds or ortolans. They eat a lot of rice and so

costly are their raids that the federal laws permit farmers to shoot them on sight.

A Queer Migration Route

When the bobolink goes south for the winter it retraces the path by which its ancestors spread across the United States. At first bobolinks spent their summers along the Atlantic coast. They moved westward as white men planted grain fields on the plains and cleared forest lands. Today we find them as far west as the Rocky Mountains. Some of them even reach British Columbia in Canada. But in the autumn they do not fly straight south from the western states. Even if they start from Utah, British Columbia or Massachusetts, they always go first to Florida and then fly to Brazil. Thus they reverse the route their ancestors used in spreading westward. (See also Migration of Animals.)

The bobolink belongs to the family Icteridae which includes blackbirds, orioles and meadow larks. The scientific name of the

SOLOIST OF THE FIELDS



The male bobolink in his beautiful mating costume of black and white sings from his perch on a weed to his quiet little brown wife. Bryant, Lowell, and many other poets have been inspired to verse by the bobolink's loud song and cheery gladness.

bobolink is *Dolichonyx oryzivorus*. The adult male is seven inches high, the female is somewhat smaller.

BOER WAR (1899-1902) The long costly Boer War—also called the South African War—consolidated British rule in South Africa. It was fought between the British Empire and two Boer republics, the Orange Free State and Transvaal.

The Boers were descendants of Dutch colonists who had settled in Cape Colony, at the southern tip of Africa. After the Cape passed into British hands the Boers began a Great Trek (migration) northward to escape British rule. On the upland plateau they farmed and raised stock. (Boer in Dutch means 'farmer'.) Gradually two independent Boer republics were formed—the Orange Free State (or South African Republic), across the Orange River from Cape

Colony, and the Transvaal, farther north. The Boers were not destined to be left alone. In the 1870's diamonds were found in large quantities in the Orange Free State. In 1885 rich gold deposits were discovered in the heart of the Transvaal. Miners and speculators poured in, chiefly from Britain. In the heart of the gold-mining district rose the city of Johannesburg. The Boers called the foreigners *uitlanders* (outlanders) and treated them harshly.

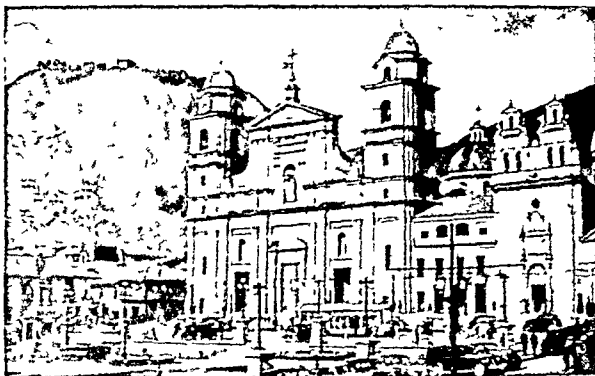
In 1895 the outlanders in Johannesburg planned an uprising against the Boers. The rising was to be supported by British troops from the outside under the leadership of Dr. Leander Starr Jameson, who was backed by Cecil Rhodes (see Rhodes, Cecil). The Jameson raid proved a dismal failure because the expected rising of the outlanders did not take place. Paul Kruger, president of the Transvaal, hardened his heart against the foreigners. The Boers began to arm. Three years later, on Oct. 11, 1899, they invaded Natal and Cape Colony.

The Boers were first-rate marksmen, and they fought in a country where they knew every pass and hill. In the first stage of the war they defeated a British army and held it under siege at Ladysmith. Other British armies were hemmed in at Kimberley and Mafeking. Then reinforcements came to the British from Canada, Australia, and New Zealand. The Boers could not bring up reinforcements, but they fought bravely under able leaders—Louis Botha, Christian De Wet, Jan Smuts.

A second stage of the war opened with the new year. Lord Roberts, commander of the British forces, captured Bloemfontein, capital of the Orange Free State, in March 1900. In June British forces reached Pretoria, capital of the Transvaal. Lord Kitchener was then given the unpleasant task of bringing the war to a definite end. He advanced slowly, burning farmsteads, and establishing camps for Boer civilians, who were aiding the guerrillas. There was a high death rate in these camps, owing largely to lack of knowledge of preventive medicine. In the armies also many died of disease. Of the British force of 450,000 men, 25,000 were killed, wounded, or missing, and twice as many were sent home as invalids.

The British finally won by sheer force of numbers. (The Boer force was less than a quarter of the British.) Peace was concluded May 31, 1902, by the Treaty of Pretoria. The Orange Free State and the Transvaal became British colonies. The English and Dutch languages were put on an equal footing, and Britain undertook to restore devastated Boer farms. In 1909 the Orange Free State and Transvaal became equal members with Cape Colony and Natal in the South African Union. Ever since the establishment of the Union, the prime minister has been a Boer, or an *Afrikaner*, as the descendants of the Boers are now called. (See also South Africa, Union of; Roberts; Kitchener; Smuts.)

BOGOTÁ'S CATHEDRAL ON THE PLAZA DE BOLÍVAR



This colonial plaza, with its statue of Bolívar, Colombia's liberator, is the hub of Bogotá. From it rise the cathedral, the capitol, and other government buildings. Visitors take a funicular railway to the church atop Monserrate, at the left, for a view of the city and the plain beyond.

BOGOTÁ, COLOMBIA. Picturesque, mountain-girt Bogotá was long one of the world's most isolated capitals. In 1538 the Spanish conquistadors toiled across the jungle from their fever-ridden Caribbean ports to build the town on a cool, fertile plateau in the Andes. They made it the capital of New Granada, and when the colony won freedom in 1819 it remained the capital of the Republic of Colombia.

For centuries Bogotá was almost cut off from the world. To reach Bogotá from the coast, travelers had to journey a week or more by boat up the Magdalena River and by mountain railway. The city grew slowly, and Bogotanos clung to their culture. They cherished their old churches, convents, and homes built in ornate Spanish colonial style, and their National University founded in 1572. They prided themselves on speaking the purest Spanish in the New World and called Bogotá "Athens of South America."

Then the airplane linked Bogotá with the world in 1920 when the first commercial airline in the Western Hemisphere began operating in Colombia. Today numerous international airlines link Bogotá's busy Techo airport with American and European centers. Amazing growth followed improved transportation. The narrow streets laid out by the Spaniards are giving way to wide modern avenues. Modernistic buildings tower above the red tile roofs of colonial houses. New parks offer meeting places and recreation centers for the people.

Bogotá is an important commercial center. Its manufactures are mainly textiles, beverages, foods, and other goods for local use. Though the city is less than five degrees north of the equator, its altitude of 8,660 feet gives it springlike weather the year round with an average temperature of 57° F. Population (1951 census), 645,255.

BOHE'MIA. More than half the people of Czechoslovakia live in mountain-rimmed Bohemia, which forms the western end of the long narrow country. Bohemia is rich in both minerals and farmlands and is a great manufacturing region. Its chief city, Prague, is the capital of Czechoslovakia (see Prague).

Bohemia takes its name which means home of the Bou from a people of unknown origin who lived here in early times. By the 5th century the country was occupied by a Slavic people called Czechs. Under strong kings Bohemia expanded its boundaries and in the 14th century it was one of the most flourishing kingdoms in Europe. John Huss a Bohemian religious reformer made it a center of Protestantism in the 15th century (see Huss).

In 1526 Bohemia passed by marriage to a Catholic ruler Ferdinand I of the Austrian house of Hapsburg. Discontent with Catholic rule brought on an outbreak in Bohemia that began the Thirty Years War. Defeat at White Mountain in 1620 crushed Protestantism and Bohemia became an Austrian crownland. Vienna continued to rule it until the first World War caused the collapse of the Austro-Hungarian monarchy. In 1918 it became the nucleus of the republic of Czechoslovakia (see Czechoslovakia).

The French mistakenly called the roving bands of gypsies who appeared in central Europe in the 15th century Bohemians. The name is now used for artists or intellectuals who lead an unconventional life. **BOHR** **NIELS** (born 1885) Albert Einstein once called Niels Bohr unquestionably one of the greatest discoverers of our age in the scientific field. Bohr richly deserved this tribute. His theory about the structure of the atom placed scientists on the road that led to the development of the atomic bomb.

Niels Henrik David Bohr was born in Copenhagen, Denmark. His father was a professor of physiology at the University of Copenhagen and Niels grew up in the company of scientists. He was a serious boy slowly speaking and studious. He entered the university in 1903 and later won the gold medal of the Royal Danish Academy of Science for work in physics.

In 1911 Bohr went to England to study with Sir Joseph Thomson and Lord Ernest Rutherford. He married Margrethe Noerlund of Nageløse, Denmark, in 1912. He returned to Copenhagen in 1916 to teach at the university and later became director of the Institute for Theoretical Physics.

By now he was world famous although still a young man. In 1922 he won the Nobel prize in physics. His brilliant theories about the electrical structure of atoms had given scientists a good grasp of the problem. He remained working quietly in Copenhagen until the second World War became imminent. In 1938 he came to the United States to work with Einstein at the Institute for Advanced Study in Princeton, N. J. Here he led a group of physicists working on problems of atomic fission.

In 1940 after the Nazi invasion of Denmark he returned to work for his country's liberation. Forced to flee three years later he escaped to Sweden and then to England. Later he worked in the United States on the atomic bomb. (See also Atoms.) **BOISE** (boi'ze) **IDAHOO** Idaho's capital and largest city. Boise has short mild winters. High mountains to the north block winter blasts and gentle winds from the Pacific Ocean maintain mild temperatures.

Autumns are long and beautiful and summer nights are cool. The fertile irrigated Boise River valley yields hay, grain, vegetables, fruits (the prunes and cherries are famed) and dairy products. *Boise* industries include the headquarters of large construction companies and manufacturers of farm tools and machinery, prefabricated houses, steel products, lumber and candy. Many workers are also employed in state departments and federal branch offices.

Intensive irrigation of the valley began in 1915 with the completion of the 350-foot high Arrowrock Dam, some 20 miles east of the city. In 1940 the 456-foot high Anderson Ranch Dam was completed. It is on the south fork of the Boise River about 45 miles southeast of Boise.

Idaho's capitol is faced with sandstone quarried on nearby Table Rock, a 1100-foot elevation once used by the Indians as a lookout. The city has both Roman Catholic and Episcopal cathedrals and the Boise Junior College Memorial Bridge which carries Capitol Boulevard over the Boise River commemorates the pioneers. The large Julia Davis Park contains golf links, other athletic fields and two pioneer cabins built in the 1860's. Boise also preserves the Blockhouse, a two-story stone structure built in 1869 as a defense against the Indians.

The Hudson's Bay Company built a trading post on the site in 1834 and the Oregon Trail forded the river at this point (see Oregon Trail). Permanent settlement began after gold was discovered in 1862 about 40 miles north in the Boise basin. In 1863 the United States established a fort at Boise and near it settlers erected cabins, feed mills, livery stables and stores. The settlement became the trade center for southern Idaho. It was made the capital in 1864, shortly after Idaho was made a separate territory. It remained the capital when Idaho became the 13d state in 1890 (see Idaho).

The city's population includes small groups of Basques, Scots and Chinese. The Basques, sheepherders, Ball and the Scots' celebration of Robert Burns's birthday are yearly festivals. Many city houses are heated with water taken from the numerous hot wells. Boise has the mayor council form of government. Population (1950 census) 34,393.

BOLEYN (boi'lin) **ANNE** (1501-1536) The second queen of Henry VIII of England. Anne Boleyn lived gaily and met death bravely. She was the daughter of Sir Thomas Boleyn and was educated at the French court. When she became lady in waiting to Henry's first wife, Catherine of Aragon, Anne soon captured the monarch's attention. He divorced Catherine and married Anne, hoping that she would give him a male heir. Anne's sudden rise to power made her so haughty and arrogant that she had few friends. Henry soon turned from her to Jane Seymour, who was to become his third wife. Anne was convicted of unfaithfulness and was beheaded. Her only child, then two years old, later became Queen Elizabeth I.

BOLIVAR Simón (1783-1830) The Washington of South America and the Liberator are the

titles given this great South American statesman and general, and with good reason. He organized and led the revolutions which freed Venezuela, Colombia, Peru, and Bolivia from the power of Spain after 300 years of misrule. He was born in Caracas (now the capital of Venezuela) of a noble and wealthy Spanish colonial family and was studying law in Madrid when Napoleon overran Spain and temporarily broke her power. All Spanish America saw its chance to strike for freedom.

Hastening home, Bolívar put himself at the head of the patriots of Venezuela. The successful insurrection in Caracas, in April 1810, was followed within a month by rebellion in Argentina and Chile. Soon the continent boiled into revolution. For the next 20 years Bolívar led a life of romantic adventure. Between victories and disastrous campaigns, he was alternately the conquering hero with an army and autocratic power, and a deserted fugitive pursued to the West Indies by hired assassins. He reached the pinnacle of his glory between 1825 and 1828 when he was president or protector of three countries

which he had liberated: the republics of Colombia (then comprising Venezuela, Colombia, Panama, and Ecuador), of Peru, and of Bolivia—the latter, formed from southeastern Peru and named in Bolívar's honor.

The spirit of disunion and opposition, however, was strong. In broken health and bitterness of spirit Bolívar resigned his offices in 1830 and retired to Cartagena (Colombia). He died the same year, at the age of 47. Not until long after his death were his character and services truly estimated. He was buried in Caracas, where the centennial of his birth saw a triumphal arch erected to his memory.

Although obliged for a time to be a dictator, Bolívar was a sincere patriot, devoted to the cause of liberty and equality. He proclaimed the liberation of Venezuela's slaves. He urged the formation of a union of American republics and called the Congress of Panama to work toward it. President Monroe gave him timely aid by recognizing the republic of Colombia and announcing the Monroe Doctrine, which notified European governments to keep hands off the nations of the Western Hemisphere.

BOLIVIA'S *Snowy* PEAKS *and Steaming* FORESTS

BOLIVIA. The South American republic of Bolivia has great natural wealth. But its riches are hard to acquire and harder still to carry to the world's markets. Mountains and jungles make transportation difficult, and the country has no seacoast. The land has rich deposits of tin, copper, silver, lead, zinc, tungsten, antimony, and sulphur. But they must be mined at altitudes of from 13,000 to 15,000 feet. Mahogany, rubber, quinchona, and other valuable trees are abundant; but they grow in steaming, mosquito-infested rain forests. The best farmlands lie in mountain-rimmed valleys. (For map, see Brazil.)

Bolivia lies in west central South America. It looks small on a map of the giant continent, but it has an area of 420,000 square miles. This is nearly one seventh as large as the United States. It has a population of more than 3 million. This is fewer than ten persons to the square mile.

About four fifths of the people live in the western two fifths of the country. Here the Andes Mountains cross from north to south in two lofty cordilleras—the Cordillera Occidental (western) and the Cordillera Real (royal). Snow-clad peaks tower to more than 21,000 feet, and several volcanic cones are

still active. Passes pierce the ridges at 14,000 feet and more. Here also veins of tin and other ores furnish most of the country's wealth.

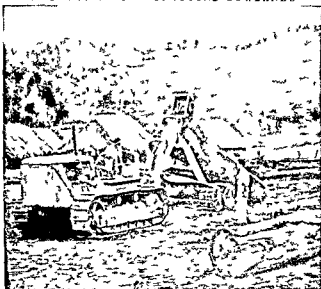
Between the cordilleras stretches a relatively level plateau called the *altiplano*, or high plain. The average altitude is about 12,000 feet. The plain is about 500 miles long and from 40 to 60 miles wide. Across the western boundary with Peru lies Lake Titicaca, at an altitude of 12,500 feet. It is the highest lake in the world with steamer service. Its fresh water drains through the Desaguadero River to Lake Poopo. There the water evaporates, leaving the lake salty. The northern and eastern slopes of the Andes are cut with

A MODERN CITY ON THE BARE, LOFTY ALTIPLANO



This view shows the Avenida 16 de Julio (16th of July) in La Paz, the principal city of Bolivia. It stands between the weathered walls of a wide canyon, at an altitude of about 12,000 feet. Behind the clouds are the summits of the Cordillera Real.

LOGGING IN THE TROPICAL LOWLANDS



Here a tractor hauls a giant mahogany log at a sawmill north of Santa Cruz. In the background stands the rain forest where the trees grow. There is no railroad in the area so the lumber is flown to the railroad at Cochabamba.

broad fertile valleys. This region is called the *yungas* or *montaña*.

The country's lowland three fifths of its area sweeps in a broad crescent around its mountain core. The northeastern plains are drained through branches of the Amazon River to the Atlantic Ocean. The southern plains are a part of the Gran Chaco. This region is drained toward the Atlantic through the Paraguay-Paraná river system. (See also South America.)

Climate Varies with Altitude

Bolivia is wholly within the tropics but its climate varies with altitude. The high peaks bear snow and ice the year around. The altiplano and adjoining slopes from 10,000 to 14,000 feet are cool with an average annual temperature of 50° F. The *yungas* grow warmer as they slope toward

the plain. The lowlands have tropical heat—an average annual temperature of 73°.

Since the country is south of the equator its winter and summer seasons are opposite to those in North America. In most places differences in temperature between the seasons are not great but the winter is the dry season and summer the wet.

Effect of Climate on People's Activities

The northeastern plains like the rest of the Amazon basin get abundant rains and are covered with dense rain forest (see Amazon River). Not many people live in this jungle because of insect pests and tropical diseases. A few Indians exist by hunting and raising cassava and other plants in small clearings. They gather wild rubber, Brazil nuts and cinchona bark. The forest has mahogany and other valuable hardwoods but only a little is cut because there are no highways or railways to carry the timber to market.

The Chaco region gets seasonal rain. Its grasslands called savannas offer abundant pasture for cattle in the wet season. But the stock may suffer or die in the dry season when pastures wither and streams or water holes disappear. This region too is thinly settled. Underground water is available for irrigation but there is no good transportation for marketing the crops.

The *yungas* region is well watered. Its cloud-filled valleys yield a variety of crops. The lowest hottest level produces sugar cane, vanilla, bananas and other tropical fruit. Slightly higher farms raise coffee, cacao and coca. Between 4,000 and 8,000 feet corn, alfalfa and temperate climate fruits flourish. In

INDIAN WOMEN SORTING ORE AT A TIN MINE



These women are picking out lumps of ore that are rich enough to export. Indian men work inside the mine. These folk have large lungs and can work in the thin air of the high altitudes better than whites.

FACTS ABOUT BOLIVIA

Extent—East to west greatest distance 570 miles to 69°38' W. longitude about 800 miles north to south 9°41' S to 2°54' S latitude about 910 miles. Total area about 420,000 square miles. Population (1950 census) 3,025,031.

Natural Features—Mountains: Cordillera Occidental and Cordillera Real of the Andes separated by the altiplano. Highest peaks: Sajama, Illimani, Huancabamba, Titicaca and Poopó. Rivers: Abasco, Beni, Mamoré, Guaporé, Madre de Dios, Grande Pilcomayo, Desaguadero.

Cities—La Paz (3,1973), Cochabamba (80,795), Oruro (67,975), Potosí (45,758), Santa Cruz, Sucre (official capital) (over 40,000).

Products—Tin, silver, copper, lead, zinc, bismuth, tungsten, antimony, gold, petroleum, rubber, nuts, cinchona bark, coca leaves, mahogany, dyewood, wheat, corn, barley, quinoa, potatoes, cattle, sheep, llamas, alpacas.

HARVESTING POTATOES ON THE ALTIPLANO



Here families of Indian tenant farmers work together digging potatoes on an owner's land. Notice the strip fields in the distance. The tenants cultivate these for themselves.

still higher valleys and basins the leading crops are wheat, rye, and oats. To be profitable, products must sell for enough to cover the cost of transportation—at least partly by pack train—to the mining camps or the cities. These products include coca leaves, cocoa, coffee, brandy made from the sugar, and *chica* beer made from the corn.

The high ridges of the Cordillera Real block the rain-bearing winds from the east, so the altiplano and the Cordillera Occidental get little moisture. They are drier in the south than in the north. Due

to drought and cold they have no trees. Natural growth is mainly the tough bunch grass, called *ichu*, the *tola* bush, *llareta* moss, and reeds beside the lakes.

How the People Live

Bolivia's people are divided in race. More than half are Indians, mainly of Quechua and Aymara language stocks. Perhaps a third, called *cholos*, are of mixed Indian and white blood. The remainder are of European descent, mainly Spanish.

Most of the Indians live on the bleak altiplano and on the brown, rocky slopes and valley pockets above it. Some of them toil in the mines or do rough work in the cities. But by far the largest number make a living by farming. This is difficult to do in such a land. There are few places on earth where people farm in so high, chill, and dry a region. Yet centuries ago the highland Indians of Peru and Bolivia learned how to make a living here. They domesticated a highland animal—the llama—to supply

meat, milk, hides, and wool. They developed hardy food plants such as the potato; and *quinoa* and *canagua*, similar to pigweed. They dug irrigation canals to bring water from the snowy peaks to their fields.

The modern Indians live much as their forefathers did. They grow potatoes, canagua, and quinoa. They take llamas and alpacas to graze on the *ichu* grass, high in the mountains near the snow line. They carry loads up the steep, narrow trails by llama pack train (see Llama). They raise a few crops and animals intro-

INDIAN BOAT, CLOTHING, AND HOUSES IN THE LAKE TITICACA BASIN



At left, an Aymara Indian poles his boat, called a *balsa*, in Lake Titicaca. He has used reeds tied in bundles to make his boat. His sail is matting made from reeds. At the right are adobe huts thatched with reeds. The man and boy wear ponchos and the women wear felt hats, full skirts, and shawls. The lump in the man's jaw is his chew of coca leaves.

duced by the Spanish conquerors in the 16th century—barley sheep burros and tough work cattle

Indian Farmers on the Altiplano

Everyone in the family must work. The farmer may use a primitive foot plow or he may drive oxen hatched to a wooden plow tipped with a piece of steel. His wife walks behind him dropping the seed. Next come the children adding a bit of fertilizer and closing the furrow.

At harvest time in May or June they cut the tough quinoa stalks with a sickle. Then they flail the plant to thresh out the seeds and toss the seeds in the air to winnow out the husks. The women make bread or gruel from the seeds.

They make a food called *chuno* from the potatoes. Spread on the grass in the early winter the potatoes freeze at night and thaw in the daytime until they become soggy. Then the women and children tramp them to squeeze out moisture and remove part of the peel. Again the potatoes lie in the sun and sharp air until they are dried to small hard pellets. These will keep for months—even years. The Indians stew them with llama or mutton. Quinoa leaves add green to the stew in spring.

Everyone must spin llama and sheep wool for the women to weave and knit. Boys carry a spindle while they herd the llamas; and the women keep the spindle twirling as they trudge over the mountain trails or sit in the market place.

Homes, Clothing and Entertainment

In this treeless land the Indians make small windowless huts of stone and adobe clay. They thatch the roof with grass or reeds. For fuel they have only tula sticks, llareta, and llama dung. The hut is cold and gloomy. At night the people wrap themselves in a llama skin and sleep on the earthen floor.

Colorful cloth brightens the drab landscape. The men wear hand woven striped ponchos over shirt and pants. A knitted wool helmet called a *lluchu* has flaps to keep the ears warm. They may set a felt hat over the helmet. The women also wear felt hats. Their full skirts come in brilliant shades of orange, purple, red and blue. When they get a new skirt they put it on over the old ones. They wear a shawl for warmth and for carrying their babies on their backs. They go barefoot even in the frosty weather.

Trips to market and fiestas on church holidays furnish entertainment. The Indians have little to trade, but families collect a hide or two, a few pounds of wool, some *chuno* and sheep-milk cheese, a lamb or a chicken to carry over the steep roads to the market place. They barter for a few manufactured things—felt hats, bright skirts, dyes. They may also trade for fruit or coca leaves from the warm yungas valleys. When coca leaves are chewed with ash of quinoa or with lime, the drug cocaine is formed in the mouth. It helps the men to endure cold, hunger and fatigue, but it is harmful to minds and bodies.

Lives of White Bolivians and Cholos

White people have governed the region since Spanish soldiers conquered it in the 16th century. They

DANCING AT A HARVEST FIESTA



Here Ayma & Indian whil in the dances. The women are dressed in the holiday clothes. There in the sands and white pebbles in the end of the usual large wool skirts.

control the best land and most of the wealth. They engage in the learned professions. Owners of the big farms called *hacendas* prefer to live in the cities and let *cholo* overseers conduct the farm. Their houses are generally built in the Spanish style, with a patio in the center. Their customs, manners and educational methods follow those of Europe.

The *cholos* are shopkeepers and skilled workers in the cities and farmers in the warm fertile lands of the valleys and basins. Some of them dress and live much as the Indians do. Others have adopted European ways.

About three quarters of the Bolivian people are *multiracial*. In recent years special efforts have been

COCA LEAVES, CHEESE AND EGGS FOR SALE



This *chola* or mestizo woman sells a bit of her own *Le Puma* set. For off, made clothing and jewelry! With the *Le Puma*, she shows that she is more *chola* than her Indian customer.

made to bring schools to the Indians and other rural people. Bolivia has advanced vocational, technical, and teacher-training schools. Its universities are in Cochabamba, La Paz, Oruro, Potosí, Santa Cruz, and Tarija. Spanish is the official language, but many Indians speak only Quechua or Aymará. The national religion is Roman Catholic.

Industries and Cities

Mining is the leading industry and tin is by far the leading mineral. More than 90 per cent of the ex-

ports are minerals and some 70 per cent of this is tin. The country furnishes about one fifth of the world's tin. Other metals include tungsten, antimony, silver, copper, zinc, sulphur, lead, and gold. Foreign capital is invested in the mines and transportation lines. Oil wells near the Argentine border supply much of Bolivia's gasoline needs. Pipelines carry the oil to refineries in Sucre and Cochabamba.

Bolivia has few factories. Raw materials, fuel, trained workmen, and transportation are all inadequate for industrial development. Factories turn out textiles, cement, flour, glass, bottled drinks, leather, and footwear. Automobiles, machinery, and the like must be imported. Some foods and raw materials are also bought abroad.

La Paz is the largest city. Most government functions are carried on here, although Sucre is the official capital (see La Paz). La Paz is on the altiplano, as are Oruro and Corocoro, the copper center. Most other cities and the high, bleak mining camps are in the Cordillera Real. Cochabamba and Sucre lie in fertile basins. Potosí, one of the highest towns in the world, has been famed for mineral wealth since colonial times. Santa Cruz is the gateway to the eastern lowlands.

Surmounting Transportation Handicaps

Transportation has been Bolivia's greatest problem. Today three railways link the cities and mines of the Highlands with Pacific ports in Chile and Peru, and a fourth connects with Argentine railways. Most of the all-weather highways are also in the uplands. The eastern plains have neither hard-road nor railway connections with the highlands or the outside world. Water transportation through rivers flowing to the Atlantic is handicapped by rapids. A highway from Cochabamba to Santa Cruz and from Sucre to Camiri is under construction. Projected railway lines have been deferred due to lack of funds.

International airlines connect Bolivia's chief centers with the cities of North and South America.

Local airlines carry passengers, mail, and freight to many places without other means of transportation.

History

The richly carved monuments and stone walls of a ruined city at Tiwanaco in the Titicaca basin indicate that an advanced people lived in Bolivia perhaps 1,000 years ago. When the Spanish *conquistadores* invaded the area in the early 16th century, it was part of the powerful Inca empire (see Incas). After the conquest, the Spanish governed it first under the viceroyalty of Peru and later of Buenos Aires. They took millions of dollars' worth of silver and gold from its mines.

In 1825, after years of insurrection, the Bolivians gained freedom, under the leadership of Gen. Antonio José de Sucre. They named their republic in honor of Simón Bolívar, who drafted its first constitution. Efforts to establish and maintain a stable government and a prosperous nation have been hampered by countless military revolts and by the rule of reckless dictators. A war with Chile (1879-83) cost Bolivia its Pacific coast. In a war with Paraguay (1932-35), the country lost most of the disputed Chaco region.

In 1952 a second revolution in less than a year put a leftist party in power. It nationalized Bolivia's tin industry.

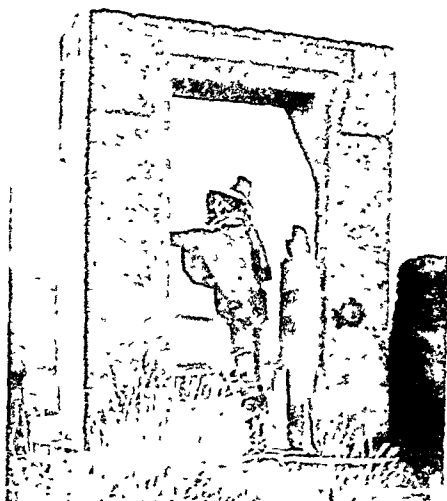
promising better working and living conditions. It also pledged land reforms. By 1953, however, little had been done and Bolivia faced the threat of a Communist uprising. (For Reference-Outline and Bibliography, see South America.)

BOLOGNA (bō-lōn'yā), ITALY. Few European cities show contrast between picturesque medieval days and busy modern commercial life as vividly as Bologna. The city lies in a fertile plain at the base of the Apennines, in the center of a railway network that follows roughly the ancient roads from Florence, Milan, Genoa, and Venice.

The arcaded streets of the old city were laid out by the Romans in the 2d century B.C. Today they are lined with busy shops. Medieval churches and palaces overlook modern theaters and office buildings. Factories in industrial zones around the medieval city turn out textiles, glass, leather goods, machinery, and electrical equipment.

Two square brick towers are famous Bologna landmarks. Built as fortresses, they lean like the blades of shears and are sometimes called the "donkey towers." The city has 130 churches, many of which date back to the 11th and 12th centuries. Two of the most famous are the massive Gothic Church of San Petronio, the

WHO BUILT THIS DOORWAY?



This arch and other ruins stand at Tiwanaco near Lake Titicaca. Nobody knows whether the ancestors of the Aymaras built the city or whether it was a ceremonial center built by an earlier people.

city a patron saint and the Church of San Domenico where lies the founder of the Dominican order of friars. Bologna also has one of the important art collections of Europe. The University of Bologna is probably the oldest existing university in Europe. It began as a law school in 1088 but soon included faculties of arts, medicine and sciences. By about 1200 the university had 10,000 students. Here Luigi Galvani discovered the electric current and Marcello Malpighi was a professor of anatomy.

Bologna was incorporated in the Papal States in 1506 by Pope Julius II. In 1860 it became part of the kingdom of Italy. The city was a center of Partisan resistance during the second World War. Factories and rail yards were damaged by air attacks. Population (1951 census preliminary) 338,710.

BOMBAY (*bōm-bā*) INDIA. The city of Bombay is the gateway to India. Its harbor on the eastern coast of India is one of the finest natural shelters in the world. It rivals the beauty of the harbors of Naples, Rio de Janeiro and San Francisco. The city itself is on an island $11\frac{1}{2}$ miles long and from 3 to 4 miles broad, but causeways and breakwaters connect the island with the mainland so that it is practically a peninsula. Along the coast line to the southward a range of mountains, the Western Ghats (stepping stones) looks down on the city.

Bombay was a Portuguese settlement (1534) but came to the English in 1661 as part of the dowry of the Portuguese wife of Charles II. It is the capital of Bombay state, one of the largest administrative divisions of the republic of India. The name comes from Bamba, Mumba, a Hindu goddess.

The city is today the largest in India because of its position on the European trade route to the East. The opening of the Suez Canal increased its prosperity and importance. It is the terminus of important railways. Cotton spinning and weaving mills have made it a great manufacturing city. It is the center of India's motion picture-making industry.

Many of the finest buildings in India, both public and private, are in Bombay. The university is one of the oldest in the nation and the city is a great educational center. It also has some of the worst industrial tenements in the world called *chawls*. They may house two or three families in a single room.

The main business section is the old district known as the Fort. It is surrounded by many pleasant hilly residential areas overlooking the sea. On Malabar Hill are the Towers of Silence where the Parsees deposit their dead to be devoured by vultures.

Though the Parsees in India number only about 100,000, they are the richest and most influential group in the community and have been mainly responsible for Bombay's industrial development. They are descendants of followers of the ancient Zoroastrian religion who fled from Persia to India about the 8th century because of Mohammedan persecution.

All India's varied peoples and religions are represented in Bombay's population and folk from every European and Asian nation mingle in the crowded

streets. Other leading cities of Bombay state are Ahmedabad, Poona, Solapur and Baroda. Area of the state, 115,570 square miles. Population (1951 census), 35,956,150. Population of the city, 2,839,970.

BONAPARTE When Napoleon Bonaparte became emperor of France and master of half of Europe, he did not forget his seven brothers and sisters. He made them kings, queens, princes and duchesses of the various lands under his control. Thus in one generation the whole common-born Bonaparte family rose to royal or high noble rank.

Their father was Charles Bonaparte (or in the Italian spelling, Carlo Buonaparte), an Italian-born attorney who practiced in Corsica. Their mother, Letitia (Letizia) was a Corsican native. Charles who died at 39 was an impractical schemer and political visionary. Letitia was healthy, energetic and strong-willed. According to Napoleon I, she possessed a man's head on a woman's body. Her characteristic qualities were strikingly evident in Napoleon (see Napoleon I).

As emperor, Napoleon granted his mother the unique courtesy title of Madame Mère (literally, madam mother). Despite her position and wealth, she remained frugal and retiring. When Napoleon was exiled to Elba, she joined him there, and when he was sent to St. Helena, she lived in Rome. In 1818 she petitioned the rulers of Europe for Napoleon's release, vowing that his illness would prevent him from ever seeking power again. She died in 1836, 16 years after her famous son's death.

A Family of Kings and Queens

The eldest of her family, Joseph (1768-1844) was a man of culture and talent whose main interest was literature. When he was made king of Naples by his brother Napoleon, Joseph introduced many much-needed reforms in that land. His troubles began when his brother took the throne of Naples from him and made him king of Spain. Joseph, unable to suppress the Spanish rebels, was driven from the throne in 1813. After the battle of Waterloo with the crash of the family fortunes, he found a place of refuge in America. He lived in Bordentown, N. J. for some time. He died in Florence, Italy, in 1844.

Unlike Joseph, who was exceedingly anxious for power, Napoleon's second brother, Lucien (1775-1840) was an ardent republican. Lucien took little interest in his brother's conquests and often quarreled with him. He never ruled a kingdom, although he held from the pope the title of prince of Canino. He died in Rome in 1840.

Louis Bonaparte (1778-1846) ranks next to Napoleon I in interest in this royal family. He was king of Holland by gift of his great brother and was father of Napoleon III, second emperor of the French (see Napoleon III). When King Louis could not rule his country in the interests of its people, he resigned his throne in 1810 and retired to Italy. Louis was the husband of Hortense, daughter of the Empress Josephine and her first husband, Viscount Beauharnais.

A kindly and sensitive nature, he was noted in his later life for his philanthropy.

The youngest son of this illustrious family was Jerome (1784-1860), at one time king of Westphalia, a kingdom created by Napoleon in eastern Germany. Before attaining this royal dignity, Jerome had been in service in the French navy. On one expedition he had to take refuge from English pursuers in the United States. While in this country he married Elizabeth Patterson of Baltimore, in spite of Napoleon's protests.

The marriage was soon annulled by order of his imperial brother, and Jerome married a German princess; but from the first alliance sprang a prominent Baltimore family. The best-known member, Charles Joseph Bonaparte, was secretary of war and later attorney general of the United States in President Theodore Roosevelt's Cabinet.

Napoleon's Sisters and What Became of Them

There were, besides the five boys, three girls in the family—Elisa, Marie Pauline, and Caroline. All of them shared in their brother's glory. Caroline, the youngest of the sisters, was married to Napoleon's general, Murat, and even attained to the dignity of queen of Naples when Murat was given that throne by Napoleon. When Caroline's husband was shot, following the final fall of the Bonapartes, she retired to Trieste, in Austrian territory. She died in 1839. Elisa (1777-1820) married a Corsican who was made grand duke of Tuscany.

Pauline (1780-1825), the gayest and most beautiful of the girls of the family, was long a thorn in the flesh to her imperial brother. She was married to Prince Borghese in Italy, but when Napoleon was removed to Elba, in 1814, she and her mother joined him there. She is even said to have expressed a desire to share his exile to St. Helena when Napoleon was sent to that remote island following the failure at Waterloo of his attempt to recover his lost power. She died of cancer in 1825. (See also Napoleon I; Napoleon III.)

BONDS. When a corporation or a government borrows money, it usually issues written or printed promises under seal to repay it at the end of a stated period and to pay in the meantime a specified rate of interest each year. Such an evidence of debt is called a bond. (See also Stocks and Bonds.)

The word comes from the verb "to bind" and is used in other senses also. Some common examples of such usage are "bail bonds" (security to appear for trial); "surety bonds" (given by officials who handle money as a guarantee of their honesty); and "bonded warehouses" (government warehouse where imported goods or alcoholic liquors are placed pending payment of revenue taxes).

BONE. In human beings and many animals, bones provide a framework for the body. They support the softer tissues by supplying surfaces for the attachment of muscles, tendons, and ligaments. Some of the bones form boxlike structures to protect the vital organs. The chest, for example, encloses the

heart and lungs; the skull protects the brain. In addition, the bones contain a soft tissue called *marrow* which manufactures blood cells.

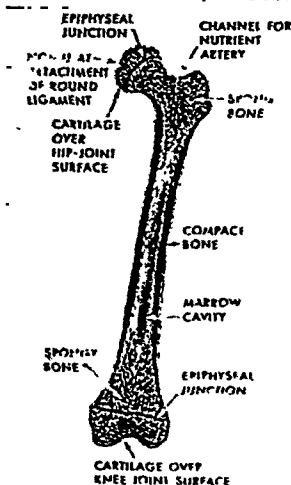
The soft tissues which the bones support also hold the bones together. The entire structure of soft tissues does so indirectly. At the joints, fibrous bands of tissue, usually in the form of ligaments, supply direct connections to join bones and hold them together. (See also Skeleton.)

The substance of bones is about half water and half solids. The composition of the solid matter in human bones, in percentages, is as follows: organic matter (white fibrous tissue), 31.03; calcium phosphate, 58.23; calcium carbonate, 7.32; calcium fluoride, 1.41; magnesium phosphate, 1.32; and sodium chloride, 0.69. The organic tissue is impregnated with the

mineral salts so completely that when the tissue is removed or disintegrates the bone keeps its shape. The fibrous tissue gives toughness and elasticity. The minerals make the bones hard. The bones of elderly people become brittle because fibrous tissue loses some of its elasticity with age.

Bones are constructed so as to provide the greatest possible strength for size and weight. Part of each bone is *compact*, or dense and heavy. But part is *spongy*, containing little hollows like those in a sponge. The

A LEFT THIGH (FEMUR)



This is a longitudinal section seen from the front. Most of the labels are self-explanatory. An epiphysal junction is a joining between parts that were separate before birth

long bones of the arms and legs each have a lengthwise hollow in the shaft. This gives lightness without much loss of strength, since a hollow cylinder is almost as strong as a solid rod of the same size and shape.

The hollows in the shafts of long bones contain *yellow marrow*. This substance is chiefly fat, but it supplies a few partly formed red blood cells. The small cavities of spongy bone are filled with *red marrow*. This substance manufactures all the red blood cells (except the few supplied by yellow marrow) and certain kinds of white blood cells.

A thin membrane called *periosteum* (*pēr-i-ōs-tē-ūm*) covers all bones completely except at joints where there is a layer of cartilage. Blood vessels and nerves lie along the periosteum before entering the bone. Long bones have one or more *nutrient arteries*. These usually enter at about the center of the head of the bone, as shown in the picture above. Nerves and one or two veins enter with them. The main blood vessels, together with auxiliary ones, divide into

PLOWING IN THE NIVERNAIS



This one of Rosa Bonheur's most famous paintings depicts a famous scene in the Nivernais, a province near Paris in the center of France where the peasants still employ oxen. Notice how the artist has brought out the slow but powerful movement of these great creatures.

innumerable branches to serve all parts of the bone and marrow. Veins are especially large and numerous in spongy bone for they have to carry away all the blood cells formed by the red marrow.

The bones of animals slaughtered for meat are used to make buttons, knife handles and similar objects, fertilizers and bone black (see Charcoal).

BONHEUR (*bôn-âr*) MARIE ROSALIE (1822-1899) What great artist had a private menagerie? The answer is Rosa Bonheur, the great French painter. She spent her life in painting animals, and she so loved her subjects that she made pets of them—even lions—which followed her about like dogs. Monkeys, deer, gazelles, goats, chamois, horses, oxen, and many

THE PYRENEES SHEPHERD AND HIS SHEEP



This painting by the great French animal artist is known as 'The Shepherd of the Pyrenees' and is one of the best examples of her work. A painter can study it for hours and constantly find new things to admire. Notice that although she was first of all a painter of animals, Bonheur handled landscape with equal skill. An artist devoting his life to landscape could not have handled better those distant mountain peaks with their clouds and the snows, nor the dreary landscape of tumbled rocks and sparse vegetation in the foreground.

other animals had their quarters in her country home at By, in the forest of Fontainebleau near Paris.

Rosa was born at Bordeaux but moved with her family to Paris when she was seven. Her father was Raymond Bonheur, a painter and drawing teacher. There were three children younger than Rosa, two boys and a girl. Their mother died before Rosa was 12, and the little girl left school to study with her father and help him bring up her brothers and sister.

Their home was up five flights of stairs, but Raymond Bonheur always had some pet for his children to love and to sketch. The brothers and sisters also spent hours in art galleries copying the pictures of great artists. Rosa loved best to sketch living animals, and she often dressed in her brothers' clothes and went to the stockyards. Since she had strong features and wore her hair short, she was accepted as a boy and admitted even to the slaughtering pens. There she studied the anatomy of animals until she knew their bodily structure perfectly.

When Rosa was only 19 the annual Paris exhibition of paintings called the *Salon* accepted two of her pictures, 'Two Rabbits' and 'Goats and Sheep'. Four years later the *Salon* awarded her a medal. This was presented in the name of King Louis Philippe. When she received it Rosa said, "Thank the King for me and tell him I expect to do better."

When Rosa was 34 she had earned enough money to buy the home at By. Except for occasional sketching trips, she spent the rest of her life there. She received many medals and honors and was the first woman to be made an officer of the Legion of Honor.

Among Rosa Bonheur's best-known paintings are 'Deer in the Forest' and 'Weaning the Calves'. These, and the famous 'Horse Fair', are in the Metropolitan Museum in New York City. Her 'Horses Threshing Corn', with ten life-sized horses, was at the time of its execution the largest animal picture ever painted. **BONIFACE** (*bôn'î-fās*), SAINT (680-755). The saint whom we know as Boniface was born near Crediton, England, of a noble Saxon family. His parents named him Wynfrith. He went to school at a monastery in Exeter, near his home, and then joined the Benedictine Abbey in Nuthall. At 30 he was ordained a priest.

At that time the wild pagan lands of Northern Europe appealed to the missionary zeal of young Christians in England, and in 716 Winfrid sailed for Frisia to convert the heathen. A war there forced him to return home after a few months. In 718 he set out again and this time he went first to Rome. There Pope Gregory II authorized him to go into Germany to preach and gave him the name Boniface. His success in gaining converts brought him consecration as a bishop in 722. Gregory also helped him secure the protection of Charles Martel, powerful ruler of the Franks.

For the next 30 years Boniface served Gregory II and his successors as a missionary-statesman in the German lands of Thuringia, Hesse, and Bavaria. He baptized thousands of converts; he founded monasteries and schools to foster Christian civilization. He organized bishoprics and set over them bishops loyal

to the pope, thus binding together the lands he was helping to civilize. He had a gift for friendship, and many of his helpers were friends who came out from England to join in his work.

After Charles Martel died, Boniface was asked to reform the Frankish church. Laboring against opposition, he succeeded in elevating the moral and educational standards of the clergy. In 748 he became archbishop of Mainz, but he resigned in 753 to go again to Frisia as a missionary. There he was killed by a band of savages. He was buried at Fulda, his favorite among the many monasteries he had founded.

Throughout his life, Boniface was an active scholar. His letters, both lively and learned, are one of the chief literary monuments of his day. He also wrote poetry and a grammar.

BONIFACE, POPES. The name Boniface was borne by nine different popes, beginning with BONIFACE I (530-532). BONIFACE VIII (1294-1303) was the most important of their number. In his pontificate occurred a bitter conflict with King Philip IV of France. During the controversy brutal agents of the king seized the aged Pope at his summer home in Anagni, and treated him with such indignity that he died about a month after his release. Shortly afterward Avignon on the river Rhone became, and for about 70 years remained, the seat of the popes—a period sometimes called the "Babylonian Captivity." BONIFACE IX (1389-1404) was one of the popes in the period of "the Great Schism," which followed the return of the papacy to Rome, while anti-popes still held forth at Avignon.

BONN, GERMANY. Before the first century, the Romans built a fortress town on the Rhine 15 miles southeast of Cologne and named it Bonna (now Bonn). Rebuilt by the emperor Julian in 359, it was ruined by Norsemen in 889. In the 13th century it was again fortified and a big cathedral, begun in the 11th century, was completed. The electors of Cologne resided at Bonn from 1265 until the French occupied the city in 1794. In 1815 it was annexed by Prussia.

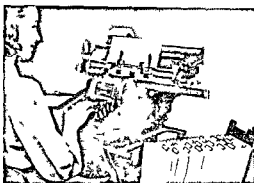
Bonn next became famous as the seat of the University of Bonn, founded by Frederick William III in 1818. It was housed in the old electoral palace and soon had five faculties—medicine, law, philosophy, and two of theology. This university quickly won favor with royalty. One of its noted students was Prince Albert, who later became the husband of Queen Victoria. Among many added buildings were an observatory and an agricultural institute. Beethoven was born in Bonn, and his birthplace was turned into a museum in 1889.

Between 1900 and 1939 Bonn almost doubled its population. It developed good railroad facilities and a brisk trade. It manufactured porcelain, stoneware, and chemicals. The natural beauties and historical interest of the city attracted foreign residents.

The second World War ruined about half of Bonn. The Beethoven museum was heavily damaged. In 1949 the war-shattered city became the capital of West Germany. Population (1950 census), 115,394.

How BOOKKEEPERS Keep TRACK of MONEY

BOOKKEEPING Anyone who wants to know what becomes of his money can easily find out by applying a simple *accounting* or *bookkeeping* method. Businessmen use more elaborate forms than are needed for personal accounts. But all bookkeeping, no matter how detailed, is based on the simple T account. This accounting device is so named because it looks like the letter T. It recognizes the elementary fact that money flows



As the operator posts entries on an account card the bookkeeping machine carries a balance for each account and a total for each day's credit and debit.

either into our pockets or out of them. The T account records this on the two sides of a perpendicular as shown below.

| CASH | |
|----------|-------|
| (Inv) | (Crr) |
| \$75 | \$12 |
| 19 | 15 |
| | \$7 |
| | Bal |
| \$94 | \$94 |
| Bal \$67 | |

ever it is desirable to know whether the sums exceed the outs or vice versa.

How Accounts Show Financial Condition

Opening the Cash account is only the first step in setting up a bookkeeping system. A person's total wealth comprises more than just his money. His home, car, personal and household belongings, insurance bonds—all these plus his actual money make up his total worth. These possessions are called *assets*. Each one has a value that can be expressed in terms of money.

He may also have certain debts or *liabilities* such as a mortgage, insurance premiums and charge accounts. He must record his liabilities so that he can tell if he is *solvent*. A person is solvent when the total value of his assets is greater than the

total value of his liabilities that is when he possesses more money (and property that can be converted into money) than he owes to others. A man can determine his *net worth* (his assets minus his liabilities) therefore only if he has accounts for all his assets and liabilities.

Businesses and other organizations too must have complete accounting systems so the executives can tell if they are operating

profitably. A company's total assets—such as its cash, building, equipment and accounts receivable (money owed by customers)—must be weighed against all its liabilities—such as accounts payable (money owed to others), bank loans and salaries—in order to ascertain the firm's financial condition.

How Entries Are Made

The basic types of accounts are (1) an *asset account* such as a Cash account and (2) a *liability account* or account of indebtedness such as Accounts Payable. A typical *asset account* is shown in Fig 1. There the Received and Paid entries are made on opposite pages of the account book. The sums received are written in the columns of the left-hand page under the heading Received. All money paid out is written in the columns under the heading

Paid on the right-hand page. Often the account is contained on just one page. The Received column is labeled Dr (*debtor*) and items in that column are called *debits*. The Paid column is called Cr (*creditor*) and items there are *credits*.

A *liability account* or account of indebtedness is shown in Fig 2. The name of the person or firm to whom the money is owed (Selby & Co.) appears on the lines above the account. The items representing the druggist's debt are entered on the right side. The money he has paid is entered on the left side. Mr. Murphy's account with Selby & Co. shows that he pur-

| RECEIVED | | | | PAID | | | |
|----------|----|-------------------------------|-------------------|------|----|-------------------------------|-------------------|
| Nov | 6 | Mrs. Daniels paid bill | \$ 8.75 | Nov | 1 | Rent | \$150.00 |
| | 17 | Dr. Jones paid on acct | 11.00 | | 10 | Selby & Co. (for merchandise) | 376.45 |
| | 30 | Drug sales (month) | 227.69 | | 15 | Light & telephone bills | 41.78 |
| | | Soda fountain sales (month) | 376.15 | | 30 | Salaries of delivery boys | 96.00 |
| | | Prescriptions (month) | 294.30 | | | Salaries of fountain clerks | 274.00 |
| | | Magazines & newspapers (mo) | 79.45 | | | Salary of drug clerk | 150.00 |
| | | Candy & tobacco sales (month) | 280.65 | | | Balance on hand | 210.26 |
| | | Total | \$1 278.49 | | | Total | \$1 278.49 |
| Dec | 1 | Balance on hand | \$210.26 | | | | |

Fig 1 Cash Account Murphy's Drug Store

chased on November 8 merchandise costing \$376.45. Two days after placing his order he received the goods and paid cash, thereby closing the account temporarily until his next order.

Double Entry Bookkeeping

In any exchange of money, goods, or services, more than one person is involved. Thus there must be two parts to every transaction. To make a complete bookkeeping record of a transaction, we must make entries in two different accounts to keep the "ins" and "outs" balanced.

For example, Fig. 1 shows that Mrs. Daniels paid her bill on November 6. Besides recording payment in his "Cash" account, Mr. Murphy also records it in another account—an "account receivable" in which he lists all her charge purchases. Thus his record of this transaction is complete. He has noted that he received a certain sum of money (by the *debit* to "Cash") and where he obtained the money (by the *credit* to Mrs. Daniels' account receivable).

This is called "double entry bookkeeping." "Double entry" does not mean that the *same transaction* is entered twice, but that *both parts* of the transaction are recorded. All entries in one account must be offset by entries in another account or accounts.

The simplest set of double entry books consists of a *journal* and a *ledger* (see Fig. 3). When a transac-

SELBY & CO.

| DR. | | | | CR. | | | |
|------|----|------|----------|------|---|------------------------|----------|
| Nov. | 10 | Cash | \$376.45 | Nov. | 8 | Merchandise Purchases: | \$376.45 |
| | | | | | | 1 gross rubber gloves | |
| | | | | | | 1 doz. thermometers | |
| | | | | | | 1 doz. bathroom scales | |
| | | | | | | 1 gross First Aid kits | |
| | | | | | | 3 doz. heating pads | |
| | | | | | | 4 doz. syringes | |
| | | | \$376.45 | | | | \$376.45 |

Fig. 2. An Account Payable, Murphy's Drug Store

tion takes place the bookkeeper first enters it in the *journal*. Transactions are entered in it as they occur. The bookkeeper regularly transfers the information in the journal to the various accounts, which are kept in the *ledger*. This is known as *posting*. Fig. 3 shows the results of the posting procedure. There Mr. Murphy made entries in his journal (top of figure) as the transactions took place. Then he posted those entries in the appropriate accounts in his ledger (bottom of figure).

The bookkeeping procedures described here furnish the information necessary to prepare three types of statements that show the financial condition of an individual or a business. They are the *trial balance*, the *profit and loss statement*, and the *balance sheet*. These statements usually are prepared at the end of a specified period, such as the calendar month, quarter year, or other desired interval. The *trial balance* is a list of debit and credit balances found in all accounts. The total of the debits must equal the total of the credits. Disagreement between totals shows there is an error (or errors) in the records.

The *profit and loss statement* tells whether the individual or business has made a profit for the period. To determine that fact, the statement shows the sources of income (sales, for example) and expenses (cost of goods sold, rent, and advertising) and the effect those items have on the *net worth*. In its simplest form the statement looks like this:

| | |
|-------------------------------|----------|
| Sales | \$21,473 |
| Less: Cost of Goods Sold..... | 15,840 |
| Gross Profit..... | 5,633 |
| Less: Expenses | 1,748 |
| Net Profit or Loss | \$ 3,885 |

The *balance sheet* is a list of all the assets and liabilities on the date on which the statement is prepared. The amount by which the total assets exceed total liabilities is known as the individual's or business' *net worth*. (See also Accounting.)

JOURNAL—R. MURPHY

| | | | PAGE | DR. | CR. |
|------|---|------------------------------|------|--------|--------|
| 19— | | | | | |
| Nov. | 6 | Cash | 1 | | |
| | | To Mrs. James R. Daniels | 3 | \$75 | |
| | | For payment of October bill. | | | \$75 |
| Nov. | 8 | Merch. Purchases | 4 | | |
| | | To Selby & Co. | 6 | 376.45 | |
| | | On account. | | | 376.45 |

LEDGER—R. MURPHY

| CASH | | | | P. 1 |
|-----------------------|------|--------------|------------------|--------|
| Nov. | 6 | Mrs. Daniels | 8.75 | |
| MRS. JAMES R. DANIELS | | | | P. 3 |
| | Nov. | 6 | Cash | 8.75 |
| MERCH. PURCHASES | | | | P. 4 |
| Nov. | 8 | Selby & Co. | 376.45 | |
| SELBY & CO. | | | | P. 6 |
| | Nov. | 8 | Merch. Purchases | 376.45 |

Fig. 3. Journal and Ledger Account Entries

The STORY of BOOKS Through the AGES

BOOKS AND BOOKMAKING
 'Of making many books there is no end' said the preacher in the Book of Ecclesiastes. This is true to a far greater degree today than it was in Biblical times. The printed and bound volume which we know today is the result of centuries of development in many arts.

The earliest records of men were scratched on bark or leather or were chiseled on stone, wood or other durable materials (see Writing). The Babylonians impressed characters on soft clay tablets or bricks and then baked them hard. The laws of Solon were carved on wooden tablets and set up on the Acropolis in Athens and the 12 tables of old Roman law were similarly engraved on stone.

Wax Tablets and Papyrus

For brief notes the Greeks and the Romans used small wax tablets called in Latin *codex* or *codicillus*. These were made of small boards. The surface was sunk to a slight depth except for a narrow ruled frame at the edges. Usually holes were bored through the

READING AN ANCIENT ROLL



This picture from an old manuscript, shows how a Roman or Greek read a papyrus roll. As he finished a column he rolled it up with his left hand while unrolling the next with his right.



This old woodcut shows a typical arrangement in the writing room (scriptorium) of a monastery. The monk is writing with quill pen on a ruled sheet of parchment, copying from the book above his desk. In his left hand is the small penknife which served as an eraser.

frame on one of the longer edges of each board. Two or more tablets were then fastened together with thongs or metal rings. A thin coating of wax commonly black was laid over the sunken part of the wood. Letters were scratched through the black wax so that the light-colored wood showed in the strokes. This writing was done with a stylus of metal or bone. At one end it had a sharp point for scratching the letters. At the other end was a knob or a flat surface for smoothing the wax if erasures were needed.

Long documents and books were written by hand on sheets of papyrus (see Paper). These were glued together by the side margins to form a long roll, 5 to 12 inches wide and 15 to 40 feet long, with writing on only one side. *Column* was the word the Romans used for such a roll and our word *volume* is derived from it. Usually the papyrus was rolled around a brightly painted and gilded stick (*umbilicus*) having knobs at both ends. To the top of the roll was attached a slip of vellum giving the title of the work and the name of the author. Each roll was kept in a cylindrical parchment case. In reading, a person held the roll in his right hand and unrolled it column by column. Meanwhile, with his left hand he rolled up on another wooden roller the part he had finished reading. When the reader had reached the end of the roll, he would customarily rewind the volume tightly upon the *umbilicus* by holding the roll beneath his chin and turning with both hands. Many of these papyrus rolls have been found in the coffins of mummies in the tombs of Egypt. The dry air of that country, together

with the cedar oil in which the papyrus was steeped, has so preserved them that the writing is still clear and distinct.

Parchment, Better Than Papyrus

Although papyrus was the material used for most ancient books, special copies were often written on vellum or parchment. Vellum was made from calfskin. Parchment, a coarser material, was made from the skins of sheep and goats. The skins were not tanned, but were prepared by careful washing and then covered with lime to

loosen the hair. After the hair was removed, each skin was stretched on a frame, scraped, dusted with sifted chalk, and polished with pumice. Vellum is probably the most lasting and the most beautiful material ever used for books, but it is very expensive. It is also hard to handle on a printing press, and so it is little used today except for special copies of fine books.

Parchment and vellum were used as early as the 5th century B.C. From the beginning of the Christian era these materials gradually displaced papyrus until by the middle of the 5th century the usual material for a book was vellum or parchment sheets. The sheets were cut to uniform size and bound together at one side with leather thongs.

Books in the Middle Ages

For nearly a thousand years after the fall of Rome all books were laboriously written out by hand. The pens were made from a reed or a quill from the wing of a large bird. These pens were cut with a broad end or nib, shaped like a chisel, unlike our fine-pointed pens. A wide stroke was made by using the full width of the pen, drawing it downward. Drawing it crosswise used only the fine edge of the nib and so produced a hairline stroke. The broad-nibbed pen thus "shaded" the letters automatically as the writer traced their curves and angles. The various forms of modern type

A PAGE FROM A MEDIEVAL BOOK

The plate on the opposite page shows a brilliant example of illuminated book work of the Middle Ages. This page is from a book produced in France about the year 1410. Scribes and artists executed the text, illustrations, and decorations entirely by hand. The amount of work which went into the making of such a book is staggering. Even when the work was divided among many scribes and artists, de luxe books like this took months or years to complete. They were very costly and none but the extremely wealthy could afford to own them. The Duke of Burgundy commissioned this volume and presented it to his uncle the Duke of Berri, a famous collector of beautiful books.

The book is known as 'Les Merveilles du monde' (The Marvels of the World). It comprises several chapters or "books" compiled from the writings of medieval travelers. The line at the top of this page reads in French, "Here begins the book of Sir William Mandeville." This name is a curious error, for the author based his account on a 'Narrative of Travels' written some years earlier, supposedly by Sir John Mandeville. Either the author or the scribe set down the traveler's name incorrectly.

The illustration shows Mandeville taking leave of his king while a page waits with his horse. The knightly traveler is dressed for a pilgrimage. Beneath is the caption "How Sir William Mandeville betook himself overseas." The text then launches into an account of the traveler's religious motives for setting out toward his first destination, the Holy Land.

letters still show the thick and thin strokes which the pen gave them during the Middle Ages, for our type letters were directly derived from the old manuscript letters.

The ink used for writing on vellum, and later on paper, was either lampblack ink, which had already been used for papyrus, or a new ink made from iron filings and oak-bark, or gill nuts, which contain tannin, boiled in vinegar. Gum arabic was added to bind the black particles to the vellum. Before beginning to write the

scribe ruled the page, marking off the margins and drawing guide lines for the writing. This ruling was done with a pointed metal stylus, or with a sharpened piece of lead, or with a pen and diluted ink. The writing desk was placed at a sharp angle, so that the leaf to be written on was in front of the scribe in an almost vertical position. Above the desk was usually another smaller one to hold the book from which the text was to be copied.

Most medieval manuscripts were the work of monks. In some monasteries the scribes worked at separate desks placed in a large room called the *scriptorium*. At times they wrote from dictation, but more often, when a book was wanted in a hurry, it was divided among a number of scribes. In other monasteries, especially in the earlier Middle Ages, each monk worked in his own cell.

Styles in Handwriting

The form of the letters used for manuscript books in Latin changed from century to century, from country to country. In the Roman period there were at least five distinct styles of handwriting. First came the capital letters, which were divided into two forms, the *square* capitals, a formal letter intended

for inscriptions and more stately manuscripts, and the *rustic* capitals, somewhat freer and easier to make, also used for manuscripts and for less formal inscrip-

HOW HANDWRITING CHANGED

| | |
|---------------|---|
| A.D. 1-500 | FORMAL-WRITING SQUARE CAPS |
| 1-500 | RUSTIC CAPITALS |
| 400-800 | UNCIALS |
| 1-500 | CURSIVE-WRITING CURSIVE becomes [H H H h h h h] |
| 400-800 | half uncials |
| 800-1200 | small roman |
| 1200-1450 | Gothic Gothic |
| 1400 | small roman |
| 1400 | Italics |
| | BOOKHANDS A.D. 1 to 1450 ± |

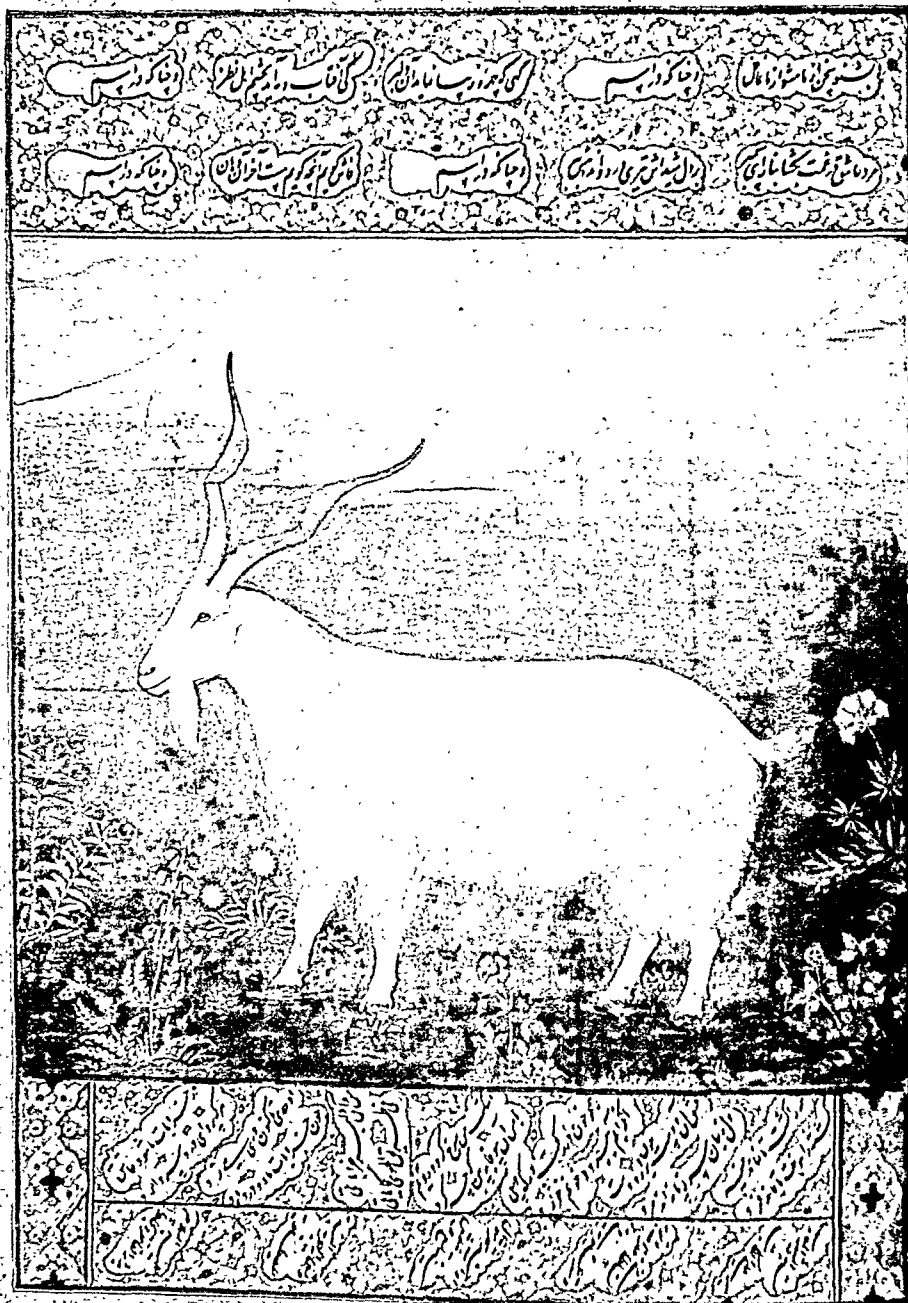
The forms of written letters were constantly changing, until the scribes perfected the styles which prevailed about 1400. Other specimens of written letters are shown on a later page of this article.



vous soit mestre guillaume de mandeuille son als oultre luy



omme il soit auant que la terre doulce mer cest adu
noir la samie terre de promission en freiloutre
autres terres cest la plus excellente et la plus digne
et dame souveraine de toutes autres terres et benoit
et sainte et l'ordinaire du premier corps (la) preme
iere nre seigneurie d'ieu crist ou sy pleut l'orden
ner en la glorieuse vierge marie et premier charma
ment et nourricion et la terre doulce et emmen
de vices et la noie il n'aura nre au les faire et freiloutre et en l'orden la joye la
loy de nouueuilliens comme a les enfants et de celle terre nouueuilliens



From the Lucy Maud Buckingham Collection

By courtesy of the Art Institute of Chicago

A PERSIAN MINIATURE OF THE 16TH CENTURY

Some of the finest examples of hand-executed bookwork are from the East. In this fine specimen emphasis is entirely on design, for the text (in the cloud-shaped panels) appears only as a subordinate part of the composition. The text is a riddle, turning on an untranslatable pun upon the Persian word for "goat." The work is dated "939 of the Prophet's Hegira"—A.D. 1533.

tions. From the capitals, later called *majusculæ*, the Romans developed a cursive hand writing, characterized by the roundness of the letters, which was used for correspondence accounts, notes, and scribbles of all sorts. This style of writing was called *uncial* perhaps because its letters were round like the Roman uncial a copper coin. From the uncial forms the printers of the 15th century developed the early type face called *black letter*. Uncial writing also developed a difference between tall and short letters and from it the first *minuscule* or lower-case alphabet was gradually developed.

The early medieval scribe combined the uncial letters with the careless letters used in writing on wax tablets (*codices*) which had strokes running above and below the regular line of letters. These new combinations were called *half-uncials*. Instead of being like the uncial writing mostly capitals with a few small letters, half uncial writing was based on minuscules or small letters with only an occasional large letter.

Next there developed from the half uncials a kind of writing which is the ancestor of our small lower-case letters. It is the *Carolingian minuscule*, the small letter used in the time of Charlemagne. The Carolingian writing was a partial return to the letter forms of the early Roman manuscripts. Its beauty and simplicity caused it to spread throughout France and it soon became the dominant style throughout all of Europe except Ireland. It was introduced into England about the 10th century but was there used first only for Latin texts,

TYPES AND THEIR WRITTEN SOURCES

PRIORE TACEANT ET SPIRITUS PROPHETARUM
PHETIS SUBCESSUNT ET MULTI ESSE
INCEDESIT TACEANT ET SIQUI LEMOS

Carolingian minuscule, of the 10th century the first Roman small letter used from 1000-1200 A.D.

Dee. Et intrareti
cular ut expmii

Angular Gothic writing (left) from 14th century English manuscript; pl. Angular Gothic type (right) based on writing from 14th century.

in preceptis proferre subdit
trem dnm qui in celis est. Qui
de cetero vel qualiter no videt

Flamish secretary hand left of 15th century, derived from Angular Gothic. Type used by William Caxton (right) derived from the hand.

procurent ut magister heret
magnates et nobles non satis
curat preter panes Abi ante

Roman book hand (left) 15th century, a revival of Carolingian minuscule. Type of Nicolas Jenson (right) patterned after it.

ruppero et disporro. La occipit
de de romans et de karthago

Ita a book hand (left) 15th century, derived from Roman book hand above. The first italic type (right) by Aldus Manutius used for 1501.

in Georgio Caroli Gualterius Carolus
olanderis Praefexit iuris intell. getia clarus
tendat ferendat et s. ocellat onces egre c. ca

First types set by Claude Garamond in France about 1530 forerunner of Caslon.

ENGLISH ROMAN

Quoque tandem abire, Castina, patens
quidam quodam nos eam furem ut nunc eludat

Types of Caslon generally considered the most serviceable face designed in England.

Book I PARADISE REGA

For that to me thou seemst the man who
Our new baptism prophet at the foot

Types of John Baskerville, a whole new line of light and wondrous the heavy ones.

Quousque tandem abutere, Catullus
a patientia nostra? quamdiu eam
corruptum tu nos elides? quem ad

Bodoni 18th century. It is a typeface overemphasized the light and heavy lines.

Donec hys hands was as hole as it had been
of the miracle a sign of the cutting a body

William Morris' Golden Type was a return to the letter of Jenson but was heavier.

O Melampus! who wouldst thou know the
why didst please the gods to direct your steps
most melancholy of them all? It is long a tale

Bruce Rogers' Centaur type is probably the finest type designed by an American.

thus establishing a fashion which continued even after the introduction of printing, Latin classics for example were always printed in Roman type whereas law books were always printed in 'black letter'.

In the later Middle Ages beginning about the 12th century there was a new development of national handwriting all derived from the Carolingian but easily distinguished from each other. This was a period of popularity for large books adorned with initials and borders in bold designs. The strokes of the letters were made wider. In Italy, southern France, and Spain the letter forms remained round. In England northern France and the Low Countries they took the pointed form.

known as angular Gothic. German script although in the northern group held a place by itself and was generally less graceful in character than any of the others. This Gothic small letter which developed slowly during several centuries became the lower-case 'black letter' of the early printers.

Finally in the 15th century came the 'humanistic writing' which was a rounded hand, an attempted revival of the old Carolingian minuscule. It was a logical result of the revival of learning for the new vogue of the classic writings of antiquity brought back the handwriting in which those works were found. These 15th century copies of the Carolingian hand became the models of modern Roman type faces. Humanistic writing like all other period forms included both a formal book hand and a more flowing form. The latter became the common handwriting.

ing of all countries which had used the humanistic roman letter for books. All italic types are based on this form of flowing or cursive letter.

How Medieval Books Were Made

The medieval book, or codex, was made of leaves bound up in order as in our printed books. The common practise was to take four pieces of vellum and fold them so that each piece formed two leaves. These pieces were then fitted one inside another to form a group of eight leaves, called a section. As many sections as were needed for the entire book were sent to the scribe, who took them apart, wrote the text a single page at a time, and perhaps put in the red headings and initial letters. Unlike papyrus, which was so thin that only one side could be used, vellum was thick enough to allow writing on both sides.

After being read and corrected, the sections of the book were sent to the binder, who sewed the sections through the back fold with cords. Wooden covers slightly larger than the leaves were made and the ends of the sewing cords were laced through holes in the boards to bind together the sections and the covers. Next a large piece of leather was glued over the back of the sections and the wooden sides. Sometimes this cover was decorated with patterns pressed into the leather with heated metal stamps. Because vellum wrinkles when it gets very dry, strips of leather with clasps were usually attached to the front edges of the boards so that the vellum leaves might be kept flat under pressure and no dust might get between them. If the book was large, metal corner-pieces with knobs were often added to keep the leather cover from touching the desk and so from being marred.

Many medieval books, especially those made for use in the church services, have beautiful decorations and illustrations painted in them in bright colors and gold. The decoration of a book with initial letters, borders in the margins of the pages, and little pictures called "miniatures" is known as "illumination."

The colors were prepared by the illuminator himself from colored earths and other substances, finely ground and washed and mixed with gum to make the particles of color hold fast to the vellum. Gold was beaten into very thin sheets and glued to the

page, or was ground into a fine powder, mixed with gum and oil, and made into a paint.

By far the greater number of medieval books were Bibles, missals (books containing the service for the celebration of mass), sermons, and other religious writings. Next in importance were books of law, medicine, and natural history, astrology, the works of Greek and Roman authors, and later a few chronicles and romances. Most medieval books are in Latin, although some of the later ones are in English, French, and the other European languages.

Among the most famous of all manuscript books are several copies of the writings of the Latin poet Vergil, now in the Vatican library. They were probably made during the 3rd century A.D. These are the earliest books in codex form which have survived to the present time. Another famous manuscript is the Codex Sinaiticus, the oldest complete manuscript of the New Testament in Greek. It was discovered by a Biblical scholar at a monastery near Mount Sinai in a basket of rubbish about to be burnt. (A photograph of a leaf of this manuscript is shown in the article Bible.) Another manuscript noted for its beautiful writing

and fine interlaced decorations is the Book of Kells. This is a copy of the four Gospels made in Ireland during the 8th century.

Manuscripts of Three Periods

The history of books in the manuscript period may be divided into three periods. In the first and longest, ending about the year 1200, the making of books was carried on by monks. In the second period, which covers roughly 200 years, the work of the monks was supplemented by literary activity in the universities, especially those at Bologna, Padua, Paris, Oxford, and Cambridge. In the third period, beginning about the year 1400, book-making and bookselling existed in the cities on a commercial basis. Venice, Florence, and Paris were the chief centers of production, and the annual fair at Frankfurt was the market where scholars could find a

copy of almost any book then in existence.

In the first period the literature of ancient Greece and Rome was saved for us largely through the efforts of two early churchmen, Cassiodorus and St. Benedict. Cassiodorus was court secretary and official

PAGE FROM A FRENCH BOOK OF HOURS



The miniature is of high artistic quality, and the artist showed ingenuity in the splendid initial "D" which gives unity to the page. The ample margins also show good taste.

THE 42-LINE BIBLE GREATEST OF ALL PRINTED BOOKS



spokesman for Theodoric and through his efforts the court at Ravenna became the center of literary activity. Cassiodorus was the first to insist that the monks should include intellectual labor in their duties, and he himself set an example by writing a history of the Church and a vast amount of other work both original and compiled.

St Benedict specified that a certain number of hours were to be spent each day in the scriptorium or writing room. Work as scribe was accepted in place of an equal number of hours of outdoor labor. For centuries the Benedictines were the most powerful of the monastic orders and it is scarcely possible to exaggerate their influence in preserving the works of the Greek and Roman authors as well as those of St Augustine, Gregory, Jerome and others of the church fathers. (See Bible, Gregory, Pines, Monks and Monasticism.)

The earliest surviving manuscript known to be the work of a European monk dates from the year 517, but even before this date much copying had been done in the monasteries of northern Africa and those in the Near East. Most of the Greek texts which found their

[illegible]

This was the first important book printed from movable type. Although this illustration is too small to show in detail the form of the individual letters, you can see that in general appearance they resemble those on the main script page below which was written in England in the 15th century. Both book and manuscript letters are Angular Gothic.

way into Europe at the time of the Renaissance came from those monastic libraries.

Bookmaking in Universities

About 1200 there was a change in the intellectual life of Europe which was henceforth directed from the universities. Alongside the production of books by monks came the work of lay scribes who were recognized as university officials. The word stationer (*stationarius*) first appeared at Bologna about 1250. The stationers kept in stock a sufficient number of

authorized copies of texts required in university courses, and rented these to students and teachers. When students died or left the university their books were turned over to the stationers, to take books away was a crime.

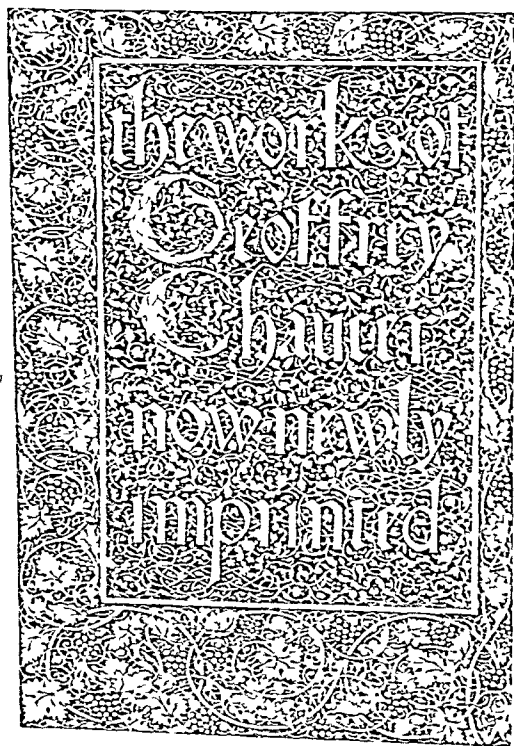
Gradually, as the universities grew in size it became the practise for the stationers to sell their texts instead of renting them and with this change

came a change in name from stationer to librarian (*librarius*). The early book dealers were really librarians as we understand the word today, for they loaned books (for a fee), and also permitted students to examine texts without removing them from the shop. The university regulations specified that the

known in Europe at least 300 years earlier. (See Paper.)

Before the invention of movable types, small religious books were printed in Europe from engraved blocks of wood. Each block was the size of the page, and consisted usually of a picture with a small amount of de-criptive lettering beneath it. These books are

A MONUMENT OF TYPOGRAPHY, THE MASTERPIECE OF WILLIAM MORRIS



The title and first text page of the folio Chaucer, printed by Morris at the Kelmscott Press in 1896, show how Morris treated the double-page of the open book as a unit. The borders and initial letters were drawn by Morris, and the illustration was done by Sir Edward Burne-Jones. This book, with the Doves Press Bible and Bruce Rogers' Centaur, are prized examples of modern typography.

booksellers must not modify the text in any way, and penalties were provided for renting or selling texts in any form other than that prescribed by the faculty. These booksellers were considered professional men, not ordinary tradesmen. In Paris they constituted a gild within the university. Admission to the gild was restricted to men of character and standing.

In England and in the Low Countries the book trade was not so closely tied to the universities, and had a larger influence on the general education of the people than in Italy or France. As early as 1400 there was an organized trade in books at Ghent, Antwerp, and Bruges, in both scholarly and popular books. In Germany the 15th century scribes gave much time to the production of textbooks, almanacs, and books on astrology, cooking, and other popular subjects.

The cost of books was greatly reduced by the introduction of paper. The use of paper began to spread about the 11th century, although it was probably

known as "block books" and the method by which they were printed is called "xylography" as contrasted with "typography," or printing from movable types. How movable types came into existence, and how their use spread through the world, is told in the articles on Printing and on Type and Typography.

Early Printing Looked Like Writing

The effort of the first printers was to make their product appear as nearly as possible like manuscripts. The style of type, the use of abbreviations and special signs, the use of woodcut illustrations in Bibles and prayer books, all followed the practise of the scribes. Blank spaces were left for large initial letters, to be drawn and illuminated by scribes after the book was printed. When woodcuts were used in printed books, they were often hand colored.

But as the press multiplied books by the thousand certain changes in their physical appearance were introduced. Some of these changes were made neces-

The Fine Art of Book Binding

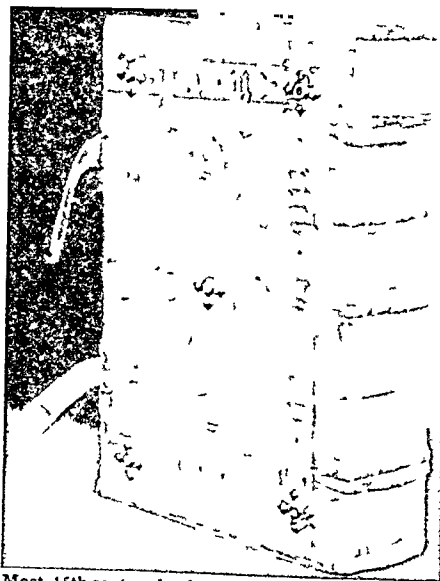
THE processes of binding a book by hand are substantially the same as they were 500 years ago. The necessary equipment includes a sewing frame, to hold the folded sheets while the sections are being sewed to the cords or tapes which run across the back, and two presses, the first to hold the sewed book while the back is rounded by gentle hammer taps, and the second to hold it while the covers are put on. In hand-binding, unlike machine- or case-binding, the sewing tapes are fastened directly to the stiff board sides before the cloth or leather covering is put on.

Decorated Covers

For decorating and lettering the cover, small brass stamps, set in wooden handles, are used. A wheel called a filet makes plain lines, and wider wheels, called rolls, with various patterns on the edges, are used for ornamental bands or borders. In gilding the edges the first step is usually to spread a thick red stain, after this is dry and carefully brushed, the binder applies a "glair," made of whites of eggs beaten up with water or vinegar, and then lays on very thin gold leaf. When the glair is quite dry, and the gold has set, the edge is burnished by rubbing with a smooth piece of stone or leather. Sometimes landscapes are painted on the fore edge in such a way that they are only visible when the edges are slightly fanned; gilding is then applied as usual to the edge, over the painting. "Full" and "Half"

Bindings

Although the processes of hand binding have remained the same, there have been great changes in materials used and in the style of decoration. The earliest bindings, even for small books,



Most 15th century bindings were made of oak boards, covered with pigskin, ornamented with stamping in blind. The metal bosses protected the bindings, and the clasps held the covers together.

were usually of oak boards. Sometimes the boards were covered with leather or vellum, these are called full-bound. Sometimes the boards were left exposed, only enough of the leather or vellum back being fastened to the edges to hold the sides; these are called half-bound. The ornamentation of the back and sides became a special art, called "finishing."

Use of Paper and Cloth

As the production of books increased and the size of the volumes decreased, the binders began to substitute paper board of various kinds for oak. About the beginning of the 19th century glazed calico was first tried as a cover for the paper boards, and about 1830 cotton cloth of various kinds was introduced in England.

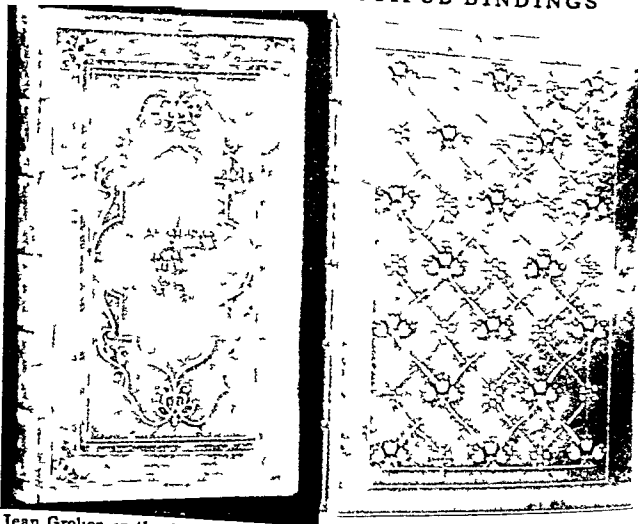
The use of cloth created new possibilities in decorative binding. Cloth is more easily handled than leather or vellum, and is easily marked by stamps or dies. It permits binding large editions in identical designs at low cost. The best grades of cloth for binding are buckrams. In the United States and Great Britain, most new books are bound in cloth. In continental Europe most books are issued in paper covers. Special

permanent bindings are put on later if the owner so desire.

As early as the 4th century many manuscript volumes were elaborately bound; but most of them were later destroyed for the gold, silver, gems, or carved ivory with which they were ornamented.

The binding of books, like the printing of them, was centered at first in the monasteries and church schools, was then transferred to the universities, and later to the commercial printing and binding establish-

OLD AND NEW IN BEAUTIFUL BINDINGS



Jean Grolier, in the 16th century, had his books bound by the best binders of his day. The book at the left shows one of his simpler patterns. At the right is a 20th century design by Cobden-Sanderson, for an essay on *The Ideal Book*, written by him and printed at his Doves Press.

ments By the end of the 15th century a few bindings appeared with the names or devices of printers or binders stamped on them. Some early printers notably Koberger at Nuremberg developed styles of bindings still associated with their names but most of the styles take their name either from a famous collector or patron or from the name of the binders.

Gilded Decoration

A great variety of decoration was made possible by the introduction of gilding about the last quarter of the 15th century. In Germany blind stamping (that is without gilding) remained the fashion even into the 18th century but in Italy France and to a less degree in England leather stamped in gilt became the material for fine bindings. In France through nearly three centuries the art of binding received magnificent support from kings queens nobles and clergy whose favorite books have since become the pride of museums libraries and private collectors. Jean Grolier one of the greatest book collectors of the 16th century had most of his books bound in leather covered with geometrical patterns inlaid with contrasting bits of leather or colored enamels. Mañich bindings made for Thomas Mañich secretary to Catherine de Medici and the English bindings made for Sir Thomas Wotton are similar in general pattern to the Grolier books. The royal binders Nicolas and Clovis Eve the unknown binder known as Le Gascon later Padeloup and the two Deromes uncle and nephew each developed definite styles of decoration which are still associated with their names. In mechanical finish the work of these early binders is often inferior to that of the best contemporary workmanship but in design it has not been surpassed.

In England in the 17th century Samuel and Charles Meares developed a cottage style of decoration taking its name from a roof like pattern which they used in almost every binding. After the Meares there was no important English binder until Roger Payne

one of the truly great binders. Payne showed great skill in combining small patterns with proper blank spaces. Payne's designs were followed with varying closeness in the 19th century by Charles Lewis Kalliober Walther Francis Bedford and later on a greater commercial scale by the firms of Riviere and

Zachnsdorf John Edwards of Halifax developed an original style usually called Etruscan from the patterns he used. Edwards made a specialty of a transparent vellum the under side of which was decorated with landscapes or allegorical paintings and he also excelled in fore-edge painting specimens of his work being now highly prized.

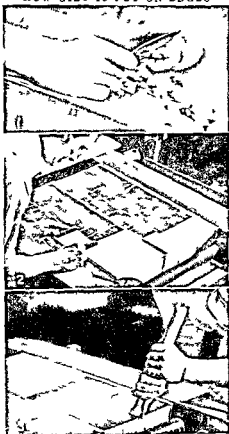
Modern Designs

Design in bookbinding received a new inspiration towards the end of the 19th century coincident with the artistic revival in printing for which William Morris was responsible. Morris and his associate Thomas J. Cobden-Sanderson designed bindings noteworthy for the dignity with which geometrical figures and conventionalized patterns are combined. Cobden-Sanderson was one of the few hand binders who himself did not only the finishing but all the sewing and forwarding. Cobden-Sanderson's influence was great not only through his own work but through his pupils among them Douglas Cockrell and Sarah T. Pradesur.

In the United States most of the outstanding binders such as William Matthews and Alfred de Sauty have been men who were born and trained abroad. They brought to this country the best European traditions and standards of workmanship.

With the turn of the 20th century the note of modernism appears in binding design as in other forms of decorative art. The student of bookbinding will be impressed just as will the student of typography with the fact that design in binding follows the general trend of other arts. Modernism in binding is comparable to the same trend in furniture or in architecture. Bookbinding is one of the fine arts and like other fine arts reflects the spirit of its time.

HOW GILT IS PUT ON EDGES



When the finisher is ready to apply the gilt he first places the book or books firmly in a press. Any sharp irregularities in the edges he removes by scraping with a sharp knife which looks like the blade of a carpenter's plane (Fig. 1). Next he applies the gilt which acts as a paste. Laying on the gold leaf (Fig. 2) requires great skill because the leaf is so thin that a sudden breath of air may crumple it. The gold leaf is picked up in a small frame as shown in the picture. After the gilt is dry and the gold is set the last step is to burnish or polish the gold (Fig. 3).

Steps in the Making of a Modern Book

WHAT are the steps in making a printed book?

When a printer plans to issue a new publication, he first prepares a "dummy," showing the paper to be used, the size of the page, the thickness and binding of the volume, and probably also showing several specimen pages set in the type to be used. Typesetting is now done almost entirely by monotype or linotype machines (see Linotype; Monotype). After the "proof" is corrected by the printer and the author, the type is made up into pages and sent to the electrotyping rooms, where copper plates of each page are made (see Electrotyping, Stereotyping). New proofs of these electrotyped plates are made and minutely scrutinized, so that any defects may be corrected. Then the plates are "locked up" in "forms," ready for the press.

The arrangement of the plates in the form presents an interesting problem. When you read a book, the page numbers, of course, follow one another in consecutive order; but that is not the way they were printed. The best way to get a clear understanding of how the pages are "laid out" is to take a large sheet of paper, rule it off and mark it as shown in Fig. 1.

Put the black numbers on one side, then turn the paper over and on the reverse side of each square write the corresponding light number. Be sure to write the numbers upside down when the plan calls for it.

Now fold the sheet across the middle horizontally, keeping the number 1 outside and uppermost; then fold it again vertically; then once more horizontally; and once more vertically, in each case keeping number 1 on the

outside of the fold and uppermost. You will then have a little book of 32 pages, and if you cut its folded edges at the top, the right-hand side, and the bottom, and leaf through it, you will find that the pages are all right side up and in the correct numerical order.

Many variations of this plan are possible so as to make up "signatures" as they are called of 4, 8, 16, 32, or 64 pages. If you examine the ordinary loosely bound book at the back you will usually be able to

discern the signatures fastened together side by side.

In Fig. 2, the inset shows a single electrotyped plate. The rest of the picture exhibits a locked-up form containing 64 such plates. The plan for this one is ingenious. The 32 pages making up one end of the

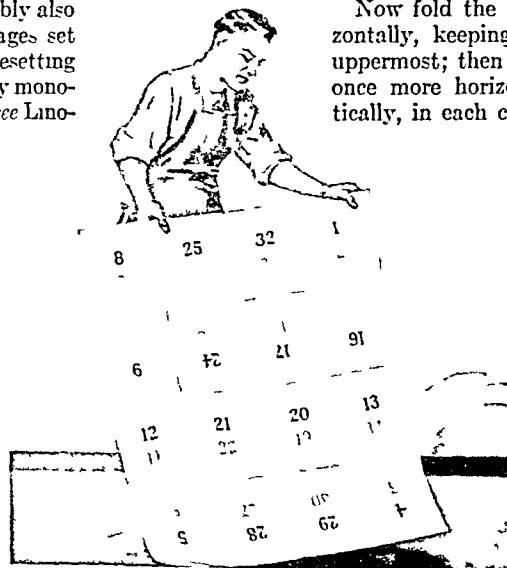


Fig. 1. How Pages Are Printed on a Sheet

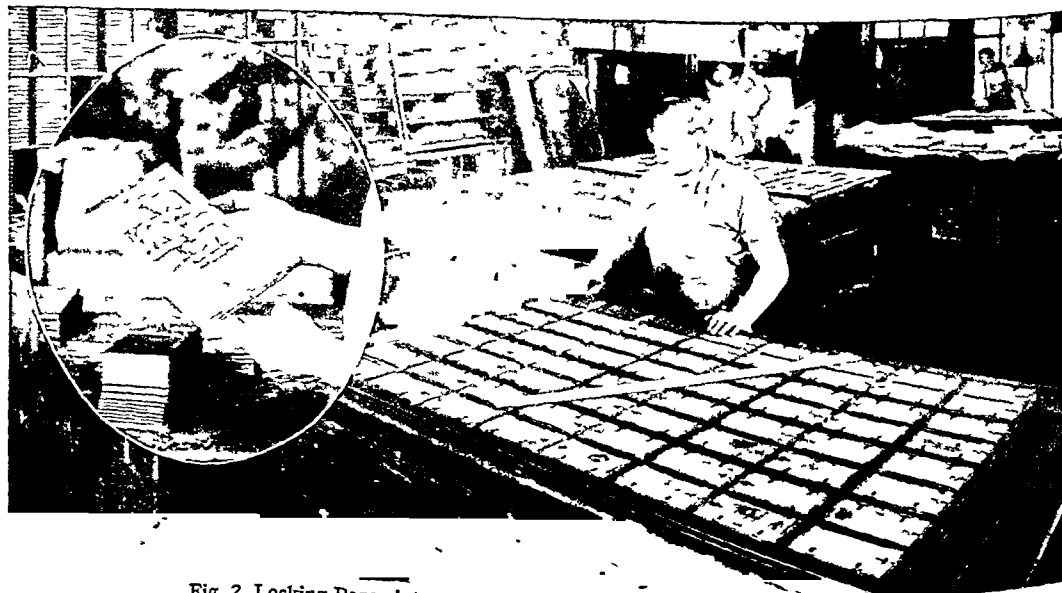


Fig. 2. Locking Pages into a Form and (in oval), an Electrotyped Page Plate

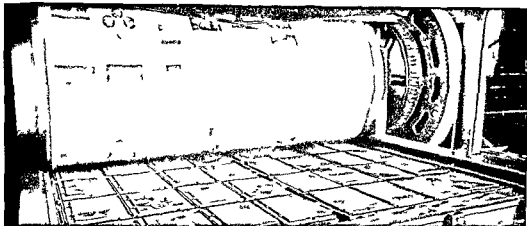


Fig 3 A Printed Sheet Coming from a Form on a Flat Bed Press

form are those that must appear on the back of the corresponding 32 pages at the other end of the form. If then a sheet of paper printed on this form on one side is turned over *end for end* and printed on the other side all of the 32 pages first printed will now be properly backed up by the opposite 32 pages. The printer then has two identical signatures on his sheet which he cuts apart in the middle folds and puts into separate volumes.

How a form is actually printed on a sheet of paper is shown above in Fig 3. The form lies on the bed of the press. This bed moves forward and backward while the paper is being fed into the machine over the large cylinder which revolves constantly. When the type bed moves back the cylinder is raised so that it does not touch the plates. At the same time the plates are run under a set of inking rollers made of an elastic composition which spreads out the ink evenly over the printing surface.

In the picture above at which you are looking you see a press at the moment

that the inked plates have finished their forward movement leaving their impression on the sheet. In the lower picture (Fig 4) the printed sheets are coming through at the back of the press at the rate of 1,200 sheets an hour and are being carried over the rollers and tapes to the delivery table or platform at the bottom. When a sufficient number of sheets has been deposited on the table it is carted away to let the sheets dry in a warm room. After the sheets are dry they are run through the press a second time to print them on the other side.

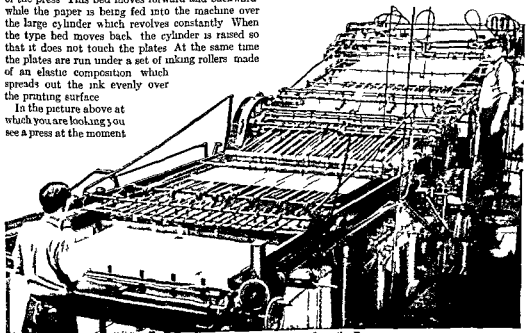


Fig 4 Delivery of the Printed Form from the Press

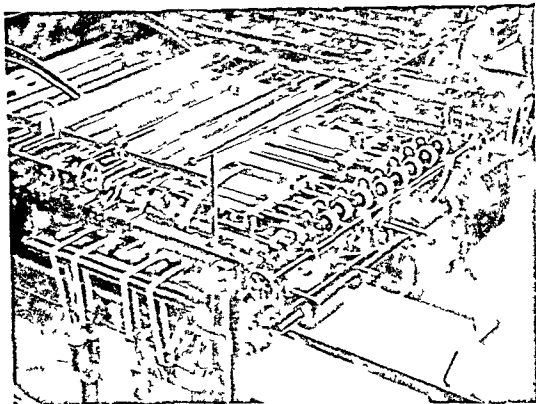


Fig. 5. The Folding Machine at Work

Next the sheets are cut and folded in the folding machine (Fig. 5). You can see the blunt folding knife at the end of the long curving arms, and below the folded signatures being delivered in V-shaped troughs. Such a machine as this one can fold signatures totaling 160,000 pages an hour.

After being folded, the signatures are "gathered." At the back of the gathering machine you can see stacks of signatures, each stack containing one signature. The clasping fingers of the machine take a

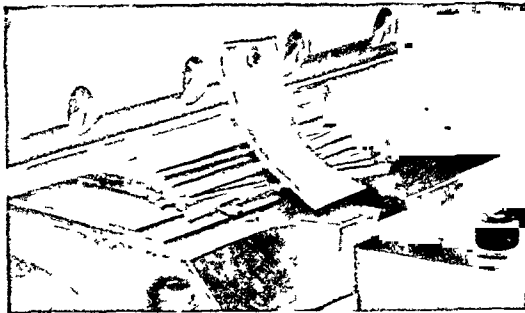


Fig. 8. The Trimmer Cutting the Book to Size

No. 2 falls on No. 1, No. 3 falls on No. 2, and so on, until at the end of the trip, at the right end of the picture (Fig. 6), each pile has one copy of each signature in the volume. The piles next go to the stitching machine (Fig. 7). In stitching, the signatures are picked up one by one by the operator, set astride the



Fig. 6. The Machine that Gathers the Signatures

signature from each stack and lay it on the moving belt at the front. As that belt moves, it carries the signatures one space at a time, so that signature

carrier arm, and fed into the machine, which sews each signature to the preceding one and also stitches each signature through the middle.

The sewed volumes are then "smashed" in hydraulic presses (Fig. 9) under a pressure of 500,000 pounds, to squeeze out the air between the pages, and then the rough or folded edges are sliced off in the trim-

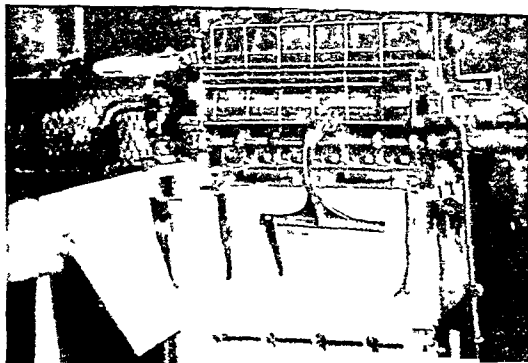


Fig. 7. Stitching Together the Pages of the Book



Fig. 9. The "Smasher" Compressing the Book

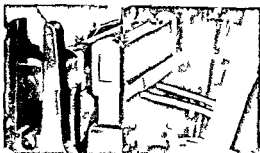


Fig 10 Giving the Book's Back Its Rounded Shape

ing machine (Fig 8). Sometimes the edges are not trimmed the book is then uncut. Trimmed edges may be left plain or they may be sprinkled marbled or gilded. Sprinkling is now commonly done with an air gun or a rubber. Marbled is done by dipping the edge of the book in a vat of oil colors which have been spattered into a pattern resembling marble.

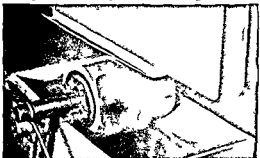


Fig 11 Gluing the Super to the Back

After the volumes are sewed and trimmed a thin coat of glue is applied to the backs which are then rounded (Fig 10). Another machine glues a strip of starched cloth called a super to the back with the edges of the super overhanging so that they may be



Fig 12 Making the Book's Cases or Covers

glued to the boards of the case or binding (Fig 11). A headband of striped cambric is then attached and end papers or linings are added. The volumes are then ready for the cases which have previously been made by other machines (Fig 12). These machines assemble



Fig 13 How High grade Gold Stamping is Applied

the heavy paper boards place linings on the inside of the backs cover the boards with cloth turn in the edges of the cloth run the cases flat through a wringer and deliver them ready for the outside decoration. The lettering or decoration is put on by brass dies in heavy presses (Fig 13).

Lastly the edges of the super are padded to the inside of the cover boards. If the back is to be tight or flat the coverings are glued directly to the rounded

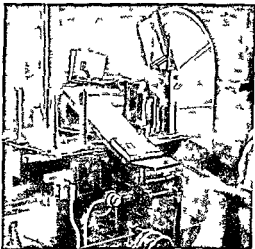


Fig 14 'Hanging' the Book in Its Case

back of the book a 'hollow' back such as the binding found on most novels and textbooks (Fig 14) allows the back to remain free and rounded with a space between it and the sheets when the book is open. The inside of the cover is then covered with a doublure half of which is pasted to the cover board and the other half forms an end paper. Doublures are usually of paper but in expensive hand bound books may be of leather or silk.

History and Principles of Book Collecting

THE collecting of books for personal libraries, as distinguished from the formation of libraries for reading or study, is a modern development. In ancient times and in the Middle Ages, there were a few collectors, but usually they were scholars, or rich men who bought books for the use of the scholars and students who frequented their houses.

The great English and French collectors, such as Grolier and deThou in France, Crammer, Archbishop Parker, and Sir Robert Cotton in England, assembled collections of the books of their times which they considered worthy of preservation. Had it not been for such collectors, many of these books would have perished. Hundreds of them, now of little value for their texts, were bound in the choicest leather by the best binders of the day. In England almost all the large collections formed before the 18th century were bequeathed to colleges and universities. The great royal library, formed by the kings and queens, was given by George II to the British Museum when that institution was opened in the year 1759.

Collectors of Today

By this time there had also grown up a class of collectors described as bibliomaniacs or bibliophiles. The bibliophile, or lover of books, as the name means, has a sentimental interest in his collection. Some collectors specialize in "association books," which may have been presented by the author to a friend or may have belonged to a famous man or woman. A book which may not be worth ten cents as a text may be worth several hundred dollars if it has on its title page the autograph of George Washington or Abraham Lincoln. Many collectors also buy books for the beauty of the printing or binding. Most collectors today make a hobby of "first editions." Later editions may include additions and corrections which improve the text, but the first edition is presumably the form in which the

author approved his creation, and is thus closer to him. Because of the demand, first editions even of contemporary writers, often bring astonishing prices.

The first editions of many books were once actually in the hands of the authors, and in this way actually acquired a sentimental interest. Laurence Sterne, for

example, signed his name on the fly-leaves of many of the volumes of "Tristram Shandy". Or again, the book may have an interest such as attaches to Thoreau's first book, "A Week on the Concord and Merrimac Rivers". The publisher was able to sell only a few copies of this book, and finally shipped all the unsold books to Thoreau at Concord. Thoreau stacked the books in his room, and wrote in his journal, Oct. 28, 1853: "I have now a library of nearly 900 volumes, over 700 of which I wrote myself. Is it not well that the author should behold the fruits of his labor? My works are piled up on one side of my chamber half as high as my head." Nine years later, just after Thoreau's death, another publisher took all these unsold copies, had the old title pages torn out and new ones pasted in. Thus every copy

with the new second edition title page was really a copy of the first edition, and had been a part of Thoreau's "library" for nine years.

For book collectors today there is only one safe rule: collect the books *you* like. No one collector can hope to complete even a small field. Many of the great rarities are in permanent public collections, and will not again be offered for sale. Many other rarities are so costly that only millionaires can hope to acquire them. But any collector, even of modest means, can assemble a collection which reflects his own interests and personality. For the beginner there are many books of helpful hints written by collectors or book dealers or librarians. Catalogs of reliable booksellers, as well as those of auction houses in the larger cities,

ONLY ANGLO-SAXON MANUSCRIPT IN AMERICA

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unþe lƿeum mannum ƿonþan
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The Blickling Homilies, a collection of sermons by an unknown author, dates from the second half of the 10th century. It took its name from the family seat of the Marquess of Lothian, in whose possession it had been for generations before its sale at auction in New York by the American Art Association in January 1932.

give much useful information. Each year records of auction sales in the United States and in England are published giving the prices at which the more important books were sold. There are numerous

The earliest known book plate was used in a Carthusian monastery in Germany about 1480. During the next 50 years German book plates reached a high degree of artistic excellence. Many of the foremost

SOME FAMOUS BOOK PLATES—ENGLISH AND AMERICAN



The collection of book plates of famous men is an interesting hobby. Such book plates are often of great value than the books in which they have been preserved, and like the books themselves they are an expression of the owner's personality. George Washington's book plate is an example of good heraldic design.



CHARLES DICKENS



DAVID WEBSTER

magazines primarily for collectors, and there is even a published list of collectors in the United States and Canada with their addresses and notations of the subjects in which each is interested.

Book Plates

The easiest way to indicate ownership of a book is to write your name on the fly leaf. Many famous people not only wrote their names, but also annotated their books with comments on what the author said. Charles Lamb, for instance, not only scribbled his comments in his own books, but also in books which he borrowed. Lamb's friend Coleridge wrote voluminous notes in many of the books which he read; many of these notes were really essays in themselves, and some of them have been published. Collectors of rare books, however, usually consider writing of any kind unless by a famous person, as lessening the value of the book, whereas a book plate may even be considered an added attraction on if it is an artistic one.

artists of the time, including Dürer, Cranach, and Holbein, designed them. The earliest French book plates were used about 1530, but the greatest French book collectors for a century longer preferred to have their arms or other devices stamped on the leather covers. The earliest known American book plate is a plain printed label with the owner's name, John Cotton, his book, and the date, 1674.

Although the vast majority of famous book plates merely show the owner's arms (see Heraldry), many are pictorial, showing portraits of the owners, library interiors, piles of books, landscapes, and even allegories and mythological figures.

Book plates may be made by a great variety of processes. A printed label is cheapest and suitable for any kind of book. Any of the photomechanical processes, such as zinc etching, or half-tone may be used, or for finer, more costly plates the design may be engraved by hand on steel or etched in copper.

Bookselling and Publishing

THE first systematized production and distribution of books appeared in Egypt especially in Alexandria about two centuries before Christ, where the Alexandrine editors prepared manuscript texts of books. In ancient Greece there was no organized book trade, although there is evidence that some people collected books at great expense and that books were sometimes sold at a stall near the market of Athens.

By the time of the Roman Empire the publication of books was a well-organized business, with its center at Rome and with trade connections with Athens, Alexandria, and all parts of the Empire, even as far distant as Britain. The smaller booksellers often made their own manuscript copies of the texts they had for

sale, but the larger dealers had copies written out by slaves. As many as 50 slaves at one time would be writing the same text from dictation. Many of the slaves were foreigners, not thoroughly familiar with Latin, and naturally made blunders, so that variations and errors crept into the texts. These careless errors have caused modern editors and students much trouble.

The Roman book trade depended on the excellent systems of communication and transportation built up by the emperors and relied for support on a wealthy, cultured leisure class. In the years of civil war and barbarian invasions the book trade came practically to a standstill until finally, with the fall of Rome in 476 A.D., it disappeared.

When printing was introduced, in the latter half of the 15th century, printers were for the most part their own publishers and distributors. The risks of this new trade were so many that few men were willing to share them with the printer. First of all was the opposition of the scribes, who formed powerful guilds (see *Guilds*). When we realize that in Paris and Orleans alone, the two centers of French manuscript production, there were more than 10,000 scribes, we can understand that they had great influence.

Most of the early printers were wanderers who sought a new location as soon as they had learned the art. The printer usually went to a strange community, sometimes even a foreign one where a different language was spoken. He had first to seek out local support. Then he would find a suitable house, for the old presses were kept steady by supports which reached from floor to ceiling. Next there was the problem of designing the type, the purchase or making of paper, and finally a decision as to what book to print. The printer's possible clients were the churches, monastic libraries, parish priests, schoolmasters, and students. General readers were of no importance in the 15th century.

A few of the first printers received aid from rich nobles. Some, especially in Italy, were supported by bishops and cardinals. Many of the monasteries in Germany and Italy established presses and had monks trained in the new art by some itinerant printer, just as they also had trained scribes.

Early Publishing Done by Printers

The printers who prospered developed a market for more books than they themselves could print. About 1480 books began to appear with statements that they were printed by one man at the expense of another. Anton Koberger, of Nuremberg, one of the greatest printers of the 15th century, not only printed several hundred books on his own presses, but hired printers in other cities to print for him. Johann Froben, the great printer-publisher of Basel, both printed books on his own account and published them at the expense of other printers.

Writing in 1523 about Froben's business, Erasmus says that there were three methods by which Froben's books were placed on sale. Small books, on which the risk was not too great, he published himself; for more important books he secured the support of an outside capitalist and acted on a commission basis for him; the third method was to sell shares in the enterprise to other publishers.

Not until about 1650 was there a well-defined class of publishers at Frankfurt and Leipzig, which by that time had become the centers of the publishing trade in succession to Venice and Rome. The publishers in these two German cities, where the great annual fairs were held, were agents or booksellers for printers in all parts of Europe. About this time began the custom of exchanging books between publishers. One publisher, in order to sell his productions, would take part of some other publisher's output in exchange for an equal value of his own books.

The early printers had no problem of dealing with authors. Most of the books printed were works of the Greek and Roman authors, or of the church fathers. Many of the printers were their own editors, and some, like Caxton, made their own translations.

With the possible exception of Aldus Manutius Froben did more than any other printer to develop the scholarship of his time, largely by persuading Erasmus and other scholars to prepare his texts and correct proofs. Erasmus was then the acknowledged first scholar of Europe, and he was probably the first modern author to make money by his writings. At the same time Erasmus also followed the fashion which prevailed then and until the 19th century of soliciting gifts from rich friends. In asking for gifts of this character an author was not considered to be asking help for himself personally, but for literature.

Instead of paying an author in money, many publishers gave him books. Sometimes an author received a stated number of copies of his own book, which he could sell for cash, or could reserve for the patron who had accepted the dedication of his book.

Modern Publishing Methods

Some time in the 18th century began the practice of issuing books by subscription. Under this plan an author would receive advance payments from subscribers. When publishers and printers adopted this method, however, their custom was not to receive any money from subscribers until the books were delivered. The publication of books by subscription is now restricted principally to expensive sets and to books on art or science with a limited field of readers.

In continental Europe it is still the practice for publishers to send shipments of their books to dealers "on consignment" or "on sale." Especially in Germany, where the book trade is most highly organized, every small dealer receives a supply of the new books which he or the publisher thinks suitable for his stock. Usually twice a year, accounts are made up and the dealer pays for such books as have been sold. The remaining books are either returned to the publisher or are allowed to remain with the dealer for sale.

The publisher has three chief objections to the consignment plan: first, he can never be certain how many books shipped out by him are actually sold; second, books returned by the dealers are often soiled; third, the demand for them may have disappeared.

These objections led to the adoption of the present "net price" system in use in England and the United States, which dates from 1900. Under this plan the publisher fixes the net price at which the book is to be sold by the retailer. Any bookseller who cuts the price runs the risk of having his supply of new books cut off by all publishers. In the United States the net price system was declared by the courts a conspiracy in restraint of trade. In effect, however, the American book trade is organized on this basis, and it is the practice of booksellers to sell books at the published prices. From the published prices the publisher allows discounts to the dealers, the percentage of discount usually being larger for a larger number of copies.

As the tendency has been to make these discounts smaller and smaller it has become more difficult for the retail bookseller to make a living

Royalties and Other Payments to Authors

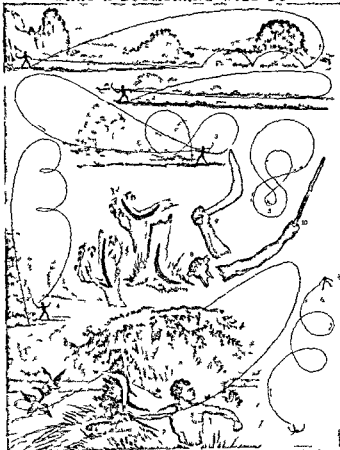
The adoption of the net-price system greatly simplified the relation of publisher to author. Formerly if the publisher paid any money to the author it was in a lump sum. Often these amounts were pitifully small. Milton received £5 for the manuscript of *Paradise Lost* and agreed to accept three additional payments of £5 when each of the first three impressions should be sold. A few authors like Pope and Dickens who were especially popular in their own time received large sums.

An author now generally receives a royalty that is a percentage of the published price on the basis of the number of books actually sold. An established author may get 15 per cent or more of the published price for every copy sold. A novel by a new unknown author on the other hand will probably bring its writer not more than $7\frac{1}{2}$ or 10 per cent royalty increasing to 10 or 15 per cent after 5,000 copies have been sold.

Formerly it was customary for an author to sell all rights to his publisher. With the development of the magazines, the radio and motion pictures this practice has changed. Now an author usually sells separately the book rights, the serial or magazine rights, the dramatic rights (if his book has possibilities for a play) and the motion picture rights. Finally he may even receive special royalties if parts of his music or play are broadcast over the radio (see Copyright). Many authors prefer to deal through a literary agent who sells the book and as many special rights as possible on a commission basis and relieves the author of all financial negotiations. A reputable agent assures the publisher that the author is dependable.

Before the second World War Germany led the world in the number of books and pamphlets published. The Soviet Union was second. In the United States private publishers have broadened their market by special methods. Book clubs sell millions of copies by mail on a subscription basis. Publishers also sell millions of pocket books—paper bound editions of works which were popular in more expensive editions. **BOOMERANG** The most remarkable weapon invented by primitive man was the boomerang used by the natives of Australia. It is made of hard wood

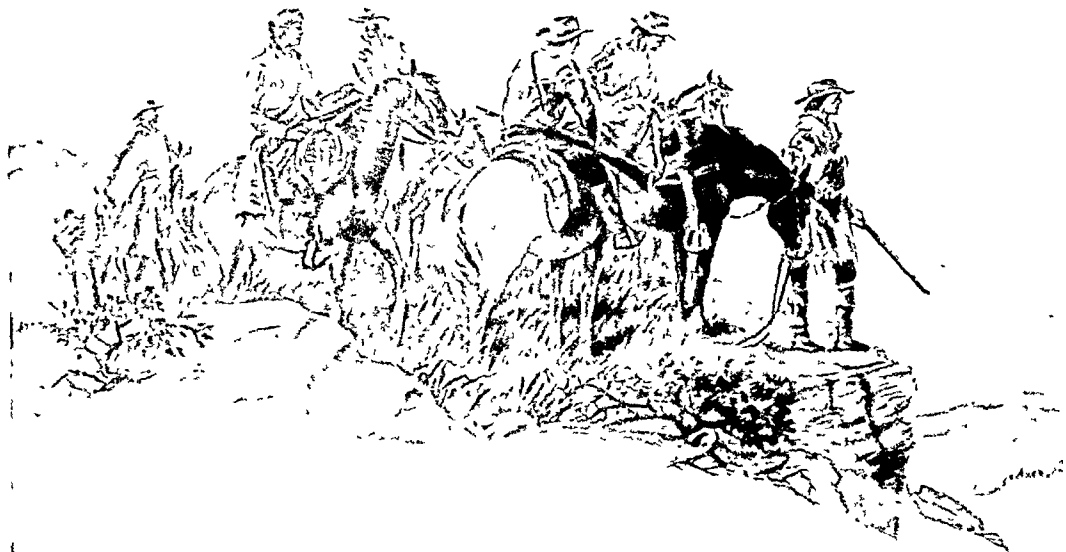
WHAT A BOOMERANG WILL DO



The Australian blackfellow makes his boomerang do many things. In No. 1 he shoots it ahead of him so that it hits the ground, makes two loops, then one big loop back to him. In No. 2 it sails through the air and comes back without touching the ground. In Nos. 3, 4, and 5 it is executing various other complicated maneuvers. No. 6 shows how the boomerang is thrown to hit a foe. In No. 7 a native brings down a duck on the other side of a tree. No. 8, 9, and 10 show how to grasp a boomerang correctly. In Nos. 11, 12, and 13 we see how various types of boomerangs are cut

into a curve over a bed of hot coals. It is from two to four feet long, flat on one side and rounded on the other with a sharp edge. There are several kinds of boomerangs—for war, for hunting, and for amusement—varying in size and proportion. The well-known return boomerang is chiefly used as a toy. Instead of going straight forward it slowly rises in the air, whirling around and around in a curved line until it reaches quite a height, when it begins to fly back again and sweeping over the head of the thrower falls behind him. This surprising motion is produced by the action of the air on the bulging side of the boomerang. The other types are effective weapons because of their size and irregular motion, but they do not return to the thrower. The natives show remarkable skill in the use of this weapon; it is said that with it they can almost cut a small animal in two at ranges within 400 feet.

DANIEL BOONE—*Fearless* HUNTER and PIONEER



From a high, rocky point in the Cumberland Gap, Daniel Boone looks down into the Kentucky wilderness below. He and his five companions thrill at the sight of pathless forests and swift streams that few white men before them had ever seen.

BOONE, DANIEL (1734-1820). When most American colonists were content to live along the Atlantic coast, a few restless men and dauntless women pushed westward through the wilderness. Beyond the blue mountain ranges a land of promise called. These hardy pioneers toiled up the steep slopes and down the long valleys toward the West. Among their leaders was the famed woodsman Daniel Boone.

Daniel came from an English Quaker family that arrived in Philadelphia in 1717, seeking religious freedom and a better way of life. His father (whose first name was Squire) pioneered into western Pennsylvania, then took up farmlands near what is now the city of Reading, Pa. Daniel was born Nov. 2, 1734, the sixth of 11 children.

The boy had no regular schooling but he quickly learned all about cattle, horses, wagons, blacksmithing, and how to weave on his father's looms. His Aunt Sarah taught him reading, writing, and "ciphering," and a very little spelling. He listened to wonderful stories at the daily family Bible reading. He made friends with the peaceful Indians who came to visit and trade. On his 12th birthday his father gave him a new rifle. As he grew older he loved to spend long days in the deep woods learning to shoot and trap. He grew up to be a man of great physical strength, quick in movement, and a swift runner.

When Daniel was about 16, the Boones decided that Pennsylvania was getting crowded. They sold their farm, and loaded the big Conestoga wagons with their belongings. They rounded up their livestock

and trekked southwest down the Shenandoah Valley in the Yadkin Valley in the northern Carolina. they staked out a farm and settled down.

In the year 1755, news came that General Braddock was leading an expedition to drive the French from Fort Duquesne. Twenty-one-year-old Daniel joined up as a wagoner with Captain Waddell's Carolina Militia. By the campfires he listened to John Findley, a fur trader, tell of the wonderful country across the mountains and down the Ohio. He saw young George Washington, then a colonel on Braddock's staff, who was about his own age. As Braddock's forces were advancing on Fort Duquesne, they were ambushed by Indians and almost wiped out. In the wild confusion Daniel cut the horses' traces and rode away to safety (see French and Indian War).

Marriage to Rebecca

When Daniel came back to the Yadkin Valley he married his Irish sweetheart, tall black-eyed Rebecca Bryan. There was a wedding party with fiddles, dancing, and a barbecue. Before long their family included two fine boys. Boone spent little time farming and more and more of his time hunting and trapping.

The Boones were movers. From one cabin to another they moved on toward the western mountains. One day, his old friend John Findley offered to show Boone the way to Kentucky. With four men they crossed the blue ranges and went through the Cumberland Gap into wild Kentucky. Boone lived in the wilderness for two years, sometimes alone for months. Once he and a companion were surprised and

captured by Indians. One night while the Indians slept the captives slipped out of their blankets and escaped.

Now he knew the way to Kentucky and settlers wanted him to guide them to the new land. But the Indians were on the warpath. Boone and his friend Stoner traveled from Carolina across the wilderness to the falls of the Ohio to warn the settlers. He helped to defend the frontier forts in Lord Dunmore's War (1774) against the Shawnees and was made a captain.

The Wilderness Road

Colonel Richard Henderson a Carolina judge had Boone gather 1200 Cherokees at Watauga Shoals in the spring of 1775. The chieftains bartered away about 2 million acres of land for a few wagonloads of guns, trinkets and gaudy shirts. Henderson then hired Boone with 30 men to cut a trail 300 miles through the wilderness to the Kentucky River. This became known as the Wilderness Road. At the end of the road they built log cabins and started a fort. They named the settlement Boonesborough (now Boonsboro).

As the settlers began to come to Kentucky the Shawnees on the Ohio River became aroused. They sent war parties to destroy the new settlements. The settlers of Boonsboro beat off every attack. One Sunday afternoon Boone's 14-year-old daughter Jemima and two other girls drifted down the Kentucky River in a canoe. They were surprised and carried off by a Shawnee raiding party. Boone and his friends followed. Creeping up on the Indians they fired from ambush. The Indians fled and the three girls were rescued unharmed.

Revolutionary War Service

During the Revolution Boone was captured by Shawnees. He was taken by the chieftain Blackfish to their British allies in Detroit. There General Hamilton offered the chief a hundred pounds for his captive. Blackfish refused and took Boone to the Indian camp at Chillicothe, Ohio, where he adopted Boone as a son. For months Boone secretly watched for a chance to escape. When he saw the warriors prepare for an attack on Boonsboro he slipped away and fled toward Kentucky. He crossed the flooded Ohio in a canoe and staggered into Boonsboro. He had traveled 160 miles in four days.

Thus Boonsboro was warned and ready. On April 7, 1778, a war party of over 400 Indians surrounded the fort. The 40 Kentucky riflemen stood at their posts behind the stockade. Inside the women loaded rifles, tended the wounded and prayed. When

ESCAPE BY NIGHT



Boone was captured by Indians many times but he always managed to escape. Here he and a companion steal away from their captors through the snow.

burning arrows set fire to the cabin roofs the men beat out the flames. The Indians even dug a tunnel to place a powder mine under the fort. For nine days the savages tried every trick. Finally a terrific rain storm plus Kentucky courage discouraged the Indians and they departed suddenly.

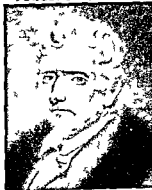
When Kentucky was made part of Virginia Boone was elected to the legislature. That body was meeting in Charlottesville when Tarleton's British cavalry made a surprise raid. They captured Boone but he was paroled. Soon he was back on the dark and bloody ground of Kentucky. Bryan's station had repulsed an Indian attack led by Simon Girty the white renegade. Boone joined in pursuing the retreating Indians. The Kentuckians rushed into an Indian ambush. As usual Boone escaped.

Peace and a New Country

Boone was now famous but he was still a poor man. The thousands of acres he had claimed in Kentucky had been lost in law courts. Because he had neglected to file papers or pay taxes he did not own an acre in the land he had opened up to others. Again the Boones moved up the Ohio from Maysville to Point Pleasant and on up the wild Kanawha Valley. Sometimes he kept store or a tavern, guided settlers over the mountains or sold horses. Always he hunted and trapped in the ever thinning forests. In 1791 he was elected to the Virginia legislature a second time. Hearing of good hunting in the Femme Osage country beyond the Mississippi in 1799 the Boones again moved west. The Spanish governor granted Boone a tract of land and made him a magistrate.

In 1804 when the American flag was raised in St. Louis Boone was once more made landless. But in 1810 he returned to Kentucky with valuable fur pelts.

PEACEFUL OLD AGE



Chester Harding painted this portrait when Boone was an old man and at peace in his last home in Missouri.

to pay old debts and bills. In Lexington he met young John James Audubon, who later became a famous painter of birds. At that time he was an impractical storekeeper in love with the wilderness. Boone showed his young friend how a good hunter "barks" squirrels and told him tales of the old wilderness days.

He returned to his Missouri cabin, happy at last to settle down with his grandchildren. Here the portrait painter Chester Harding painted his picture. Had he ever been lost in the trackless wilderness, Harding asked. "No, but I was bewildered once for three days," said the old hunter with a twinkle in his eyes.

He was 86 when he died. They buried him by Rebecca on a hilltop overlooking the Missouri, facing the sunset. Years later Kentucky remembered its debt to the trail blazer and took his body back to Kentucky soil for burial beneath a monument.

Books for Younger Readers

Brown, J. M. Daniel Boone, the Opening of the Wilderness (Random, 1952)

Daugherty, J. H. Daniel Boone (Viking, 1939)

Meadowcroft, E. L. M. On Indian Trails with Daniel Boone (Crowell, 1947)

Books for Advanced Students and Teachers

Bakeless, J. E. Fighting Frontiersman (Morrow, 1945)

White, S. E. Daniel Boone Wilderness Scout (Doubleday, 1946)

BORAX. Wherever the mineral borax is found in large quantities there once stood an ancient lake of bitter-tasting water. Then the climate changed and the lake dried up, leaving a glittering layer of white crystals, covered later perhaps by mud or dust. But not enough rain ever came after that to wash the borax away. So today the world's supply of borax comes chiefly from waterless deserts.

Borax is a mineral form of the salt called sodium borate ($\text{Na}_2\text{B}_4\text{O}_7$). It is a mild alkali useful as a "water softener" in kitchen and laundry work. On hot metal borax powder melts to a glassy liquid which dissolves oxides and other surface impurities. This action makes it useful as a flux in brazing and welding. Borax is used for making heat-resisting glass such as pyrex baking dishes and electric-lamp bulbs. It is used also in enamels for bathtubs, cooking utensils, and other metalware; glazes for pottery and paper; and food preservatives, antiseptics (including boric acid), and leather dressings.

The world's best source of borax is deposits of almost pure sodium borate, called *kernite* or *rasorite*, in the Mohave Desert, Calif. They have largely replaced less pure deposits of *colemanite*, *ulexite*, and *tincal* in Death Valley, Calif., in Chile, and in Tibet. Potash brines of Searles and Owens lakes in California, and salt lakes and marshes in Turkey and Italy yield additional supplies.

Borax and boric acid (H_3BO_3) are among the few important compounds of boron. The *borax bead test* is used to identify unknown metals. Borax on a small platinum loop is heated to a glassy bead, touched to the substance to be analyzed, and reheated. The bead turns green for chromium, blue for cobalt, yellow for iron, and so on.

BORDEAUX (*bór-dô'*), FRANCE. One of the leading seaports of France is Bordeaux, on the left bank of the Garonne River. It is near the south of France and hence conveniently located for trade with West Africa and South America. It is 60 miles from the Bay of Biscay, and near the point where the Garonne and the Dordogne meet to form the Gironde River.

The city is famous for its wines, which are exported in large quantities. Other valuable exports include hides and skins, sugar, rice, cotton and woolen cloth, fish, fruits, and vegetables. A large fishing fleet goes from Bordeaux to the Grand Banks each year.

The harbor is divided by the Pont de Bordeaux, a bridge of 17 arches. The city boasts many fine old buildings. Notable among them are the Cathedral of St. André, dating from the 11th century; the Grand Théâtre; and the church of St. Michel, whose bell tower, 354 feet high, is the loftiest in the south of France. Bordeaux has been an educational center for many centuries and is the seat of a university founded in 1441. It is the birthplace of Montaigne, the essayist, of Rosa Bonheur, the painter; and of Montesquieu, the political philosopher.

As far back as the Roman Empire, Bordeaux was a flourishing city, called *Burdigala*. Its western position protected it from the early barbarian invasions, and it sheltered the last glimmers of Roman culture when the rest of France had entered the Dark Ages.

In 1152 Eleanor of Aquitaine married Henry of Anjou. When he became Henry II of England in 1154, the Bordeaux region passed under English control for three centuries. Bordeaux became French again at the end of the Hundred Years' War. During the Franco-Prussian War, and briefly in each of the two World Wars, the French government moved to Bordeaux. Population (1946 census), 238,653.

BORDEN, SIR ROBERT (1854-1937). The Right Hon. Sir Robert Laird Borden, prime minister of Canada from 1911 to 1920, was born in the historic village of Grand Pré, Nova Scotia, on June 26, 1854. His family had been in Nova Scotia since 1760. After an education in the provincial schools he became a barrister, and rose rapidly to prominence.

Law proved a steppingstone to politics. In the general elections of 1896 he was elected to the Dominion House of Commons as a Conservative. In 1901 he was chosen leader of his party, in the House and led it in opposition to the dominant Liberals. Then in 1911 the Conservative party swept the country in opposition to a trade reciprocity agreement with the United States, and Borden was asked to form a cabinet. (He was knighted in 1914.)

During his first few years as prime minister, Sir Robert Borden was hampered by the opposition of a Liberal majority in the Canadian Senate. But the outbreak of the first World War brought a truce to party strife. On the declaration of war he offered Canada's whole-hearted support. Starting with an expeditionary force of 33,000 men, he placed before the Canadian people the goal of 500,000 men as Canada's contribution. When the need for men grew

acute he asked parliament to adopt compulsory military service. To carry this measure he formed a coalition with the conscriptionist wing of the Liberal party. The general elections of 1917 justified his policy and he was able to carry forward Canada's part in the war. Among the prime ministers of the Allied nations Borden was the only one who directed the affairs of his country from first to last.

In 1917-19 Sir Robert Borden was a member of the Imperial War Cabinet composed of five ministers of the United Kingdom and the prime ministers of the self-governing dominions. Previous to this in July 1915 he had sat in the Imperial Cabinet. This was the first time an overseas minister had ever participated in the deliberations of this body.

At the end of the war, in 1918 Sir Robert Borden went to Paris as the chief representative of Canada at the Peace Conference. He led in obtaining for Canada and the other self-governing dominions of the British Empire due recognition as members of the League of Nations. But the strain of his labors had told upon his health. Shortly after his return to Canada he was obliged to relinquish the duties of prime minister. In the summer of 1920 he resigned and retired to private life, handing over his leadership to one of his lieutenants Arthur Meighen.

Borden was not inclined to practice the minor arts of the politician. But his formation of the Union Government in 1917 in the face of strong opposition within his own party required remarkable gifts of patience, perseverance and firmness of purpose. He did not possess the oratorical gifts of Sir Wilfrid Laurier and his speeches were marked by earnest appeal to reason rather than by eloquence. Throughout the war he acted with great promptitude and vigor as occasion demanded. He died June 10, 1937.

BORGIA (bôr'jâ) FAMILY Of all the princely houses of Renaissance Italy none was more powerful between 1455 and 1504 than this family of Spanish origin which gave two popes to Rome (Calixtus III 1455-1458 and Alexander VI 1492-1503) and which in Caesar Borgia (1476-1507) supplied the perfect

type of the coldly calculating unscrupulously wicked Italian tyrant.

Alexander VI frankly used his office to build up the power and fortunes of his children whom he openly acknowledged. Trickery, war, poison and the

dagger were freely used to advance the family interests though historians now disbelieve most of the tales of subtle and secret poisonings attributed to Alexander and his son Caesar as beyond the chemical knowledge of that time. The almost royal power of Caesar Borgia practically ended when his father was fatally stricken at a banquet in 1503 and he himself was temporarily incapacitated by a mysterious illness which their contemporaries attributed to poison which they had placed for their enemies.

Caesar's sister Lucretia Borgia (1480-1519) was represented by later writers as a veritable monster of wickedness. But she is now believed to have been 'more stained against sinning and a mere tool in



Sir Robert Borden won international distinction as Canada's premier during the first World War and as chief representative of the Dominion at the Peace Conference. Throughout those troubled days he was conspicuous for his ability and ease.

the hands of her unscrupulous family. In her later life as duchess of Ferrara she showed herself a woman of beauty, grace and gentle manners as well as a beloved patron of artists and scholars.

St. Francis of Borgia (1510-1572) a later member of the Spanish branch of the family attained fame as the pious and able head of the Jesuit Order.

BORGLUM Gutzon (1867-1941) Of rugged Danish ancestry Gutzon Borglum was born in Idaho and educated in Nebraska when the West was still the frontier. To this environment he owes the bold imagination of his sculpture. To his training in Paris under Rodin's influence he owes his technique. Noteworthy examples of his work are the national memorial on Mount Rushmore, South Dakota, with its huge heads of Washington, Jefferson, Theodore Roosevelt and Lincoln; a head of Lincoln in the Capitol at Washington; The Centaurs in Newark, N.J. and 'The Mares of Diomedes' in the Metropolitan Museum, New York City. He designed the Confederate Memorial on Stone Mountain, Georgia, but the work was stopped after a disagreement with the sponsors. His brother Solon Hannibal Borglum (1868-1909) was also a distinguished sculptor. (See also Sculpture.)

The VAST and SAVAGE ISLAND of the DYAKS

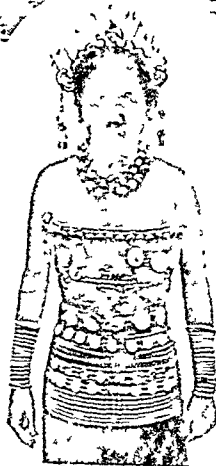


BORNEO. If you visit the

Dyaks, one of the primitive peoples who live along the jungle rivers of the island of Borneo, in the Malay Archipelago, you will sleep in a huge barnlike structure built above the ground on high stilts, with a great cluster of smoke-blackened human skulls grinning down at you from the rafters. For the Dyaks feel they honor a visitor by lodging him in this "head house," where they keep the heads they have cut from the bodies of their slain enemies. The roofs of their "long houses," 600 to 700 feet long, are steeply pitched to withstand the torrential rains, for Borneo, with an average fall of 150 inches, is among the wettest places on earth. Head hunting has been suppressed among the tribes living near the coast, but in the dense jungles of the interior, some wild tribes still practise the grim rite.

The Dyaks are the original "wild men of Borneo." They are still ghost-worshiping semi-savages who seek guidance for important projects from omen-birds, usually hawks, or read the will of their pagan gods in the entrails of sacrificed pigs and fowl. Over their queerly tattooed brown skins they wear only the scantiest of coverings, for the climate is oppressively hot.

The Dyaks are divided into many tribes, but Borneo natives are generally classed as Dyaks and Lauts, or Sea Dyaks, meaning inhabitants of the coast. The latter, mostly Mohammedans, are also called Ibans.



Other tribes are the Kayans, Kenyahs, Kalabits, Klemantans, Muruts, Dusuns, Bajaus, Punans, and Ukits, mostly pagan peoples. The Ibans are the most warlike and industrious. The most primitive tribes are the Punans and Ukits, who subsist on jungle foods, mainly wild sago, and by hunting, and live in the dense forests in shelters made of sticks and weeds. Rice is the staple food of the more advanced tribes.

Borneo, with an area of more than 290,000 square miles, is the third largest island in the world, exceeded in size only by Greenland and New Guinea. It is 800 miles long and 600 miles wide at its longest and widest points. North of it are the South China Sea and the Sulu Sea. To the east are the Celebes Sea and the Strait of Macassar, and the Celebes and Sulu Islands; to the south, the Java Sea and Java; and to the west the South China Sea and Sumatra, the Karimata Strait and the Malay Peninsula.



Behind the waterfront homes of the upper picture, built on stilts 15 to 20 feet above the muddy water, rises the roof of a typical Bornean "long house." In the next picture a Dyak beauty proudly displays her collection of native jewelry, consisting mainly of brass and copper rings strung on rattan. Below, we see the wharf of Pasir, one of the seven ports of Indonesian Borneo, where rattan is exported.

From an airplane this vast island looks like one great emerald patch of jungle, with ridges of four forest-clad mountain chains traversing it irregularly from north to south. Mount Kinabalu in North Borneo is the highest of the peaks, reaching over 13,500 feet. Threading the mysterious forests—some still unexplored—are many silvery rivers dotted with small

trading boats and fishing canoes. These rivers are the highways of Borneo. The natives ply the rivers in swift boats called prahus or proas outrigger craft which sail just as well forward or backward because both stem and stern are pointed and the mast is amidships.

In the gloom of the great forests are ironwood, teakwood, ebony and other valuable trees which form the country's chief natural resource. Camphor trees, fan palms, coconut palms and

many delicate ferns also abound. Through tangled jungles stalk the wild Malay ox, the tufted pig, the honey bear, the rhinoceros and the elephant. The orang utan, that powerful human-looking ape called by the natives *manas*, the jungle man and the gibbon—a monkey that looks even more like a man than does the orang utan—swing through the lofty trees. Along the branches at night dart the flying fox and the flying frog. Crocodiles haunt the rivers and these with snakes and lizards make Borneo an important source of reptile skins. The many streams swarm with edible fish.

The largest and richest part of Borneo long belonged to the Dutch, but in 1949 it became part of the new free nation of Indonesia. The population of Indonesian Borneo is 3,000,000 (1950 est.); the area is 207,000 square miles. The chief region with about three-fifths of the people is West Borneo. Its major city is Pontianak. Balikpapan is the refinery center for East Borneo's petroleum and Samarinda is the chief port. Bandjermasin exports coal and rubber from Bandjar (South Borneo).

Sarawak and North Borneo became British protectorates in 1888 and Brunei in 1893. Sarawak with an area of some 50,000 square miles and 546,380 people (1947 census) was long ruled by white rajahs. In 1839 Sir James Brooke, an Englishman, helped the Sultan of Brunei to put down a revolt and was made rajah of Sarawak in 1841. His heirs ruled until 1946 when Sara-

wak became a crown colony. The capital is Kuching. Other towns are Miri and Sibuan. The British protectorate of North Borneo became a British crown colony in 1946. Population (1951 census) pre-

liminary) 334,141; area 31,000 square miles. Brunei remained a British protectorate ruled by a native sultan. Population (1947 census) 40,600; area 2,500 square miles.

In the second World War Japan attacked to obtain oil for Borneo is one of the chief sources in the Far East. Petroleum is found in Sarawak, North Borneo, East Borneo and near by Tarakan Island. Early in 1945 Australian troops, aided by American naval and air forces, recaptured these rich oil fields from the Japanese.

Other mineral wealth includes coal, iron, gold, diamonds, silver, platinum, tin, mercury, rock salt and porcelain clay. Its chief products are spices, nuts, camphor, gutta-percha, sago, rattan and numerous tropical fruits such as pineapples and bananas. Sugar cane, coffee, cotton, rice and tobacco are cultivated along the coast and rivers. Rubber tree plantations now provide more than a third of the export trade. Agriculture is the main occupation, boat building, weaving, iron working and the making of baskets and mats from bamboo and rattan are leading industries. The population of Borneo is about 4,000,000.

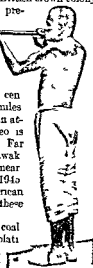
THE ENTERING WEDGE OF CIVILIZATION



Good schools are found in the coast cities of Indonesian Borneo. But few of the pupils are Dyaks. Most pupils are Malays like these girls from Bandjermasin. Their ancestors settled on Borneo in the 14th century. Few Dyaks yet care about getting an education.

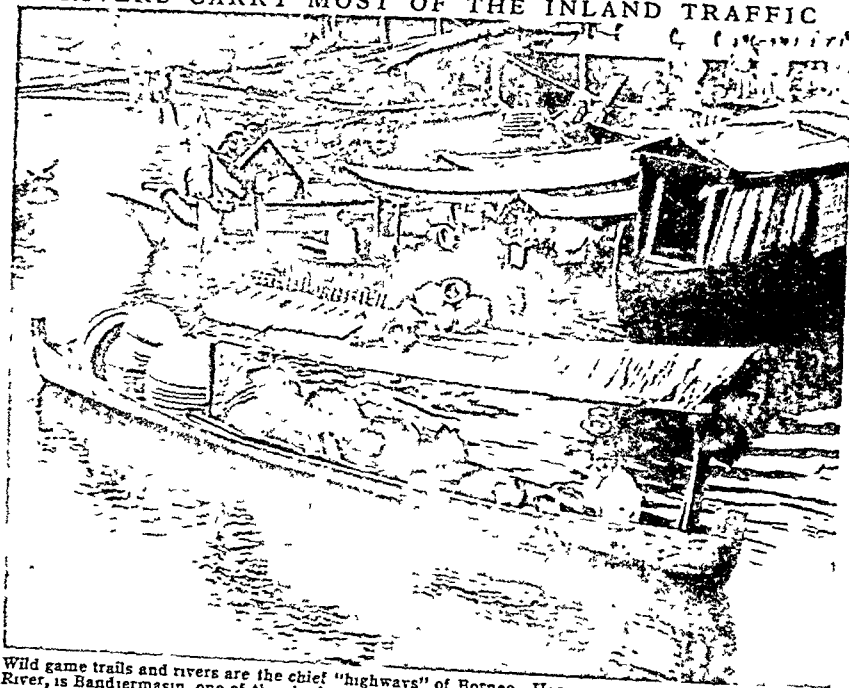


The magnificent physique of this Murut pack carrier makes light of heavy loads and mounts a climb.



In the hands of the Borneo man the blow gun is a deadly weapon. Its poison can be blown as far as 70 yards.

RIVERS CARRY MOST OF THE INLAND TRAFFIC



Wild game trails and rivers are the chief "highways" of Borneo. Here, near the mouth of the Barito River, is Bandjermasin, one of the chief trading centers of Indonesian Borneo on the southern coast. The boat in the foreground is loaded with huge hats made of fiber.

Chinese traders are supposed to have been the first to visit Borneo, in the 7th century. Ferdinand Magellan's crew appeared there in 1521 after Magellan's death. The British and Dutch attempted to exploit the island in the 17th century but with little success. The Borneo natives along the coast turned pirates and preyed upon shipping for many years, but the British ended their piracy about 1845. The native rulers then granted them a foothold in North Borneo.

The Dutch also returned, but concessions to the British kept them out of the north. The Dutch and British established long disputed boundaries in 1891. (For map, see East Indies.)

BOS'NIA AND HERZEGOVINA. In Sarajevo, capital of the Austrian province of Bosnia, was fired the first gunshot of the first World War—the shot that snuffed out the lives of the Austrian archduke Franz Ferdinand and his wife, and started hostilities between Austria and Serbia (see World War, First).

Bosnia and Herzegovina, lying in the extreme northwestern portion of the Balkan Peninsula, and comprising less than 20,000 square miles—about twice the size of Vermont—have had a stormy history. They were a part of the Roman Empire, but after the barbarian invasions

they belonged at one time to Hungary, at another to the Serbs, and again they were independent. In the 15th century, with the rest of the Balkans, they fell under the power of the Turks, and there they remained until, at the close of the Russo-Turkish War of 1877-78, they were handed over to Austria. After the first World War they became part of Yugoslavia (see Yugoslavia).

Most of the region is high and mountainous with fertile valleys and great forests. Agriculture is the principal occupation. Sugar refining and rug making are among the few manufactures. The chief exports are iron, timber, and dried fruit.

A third of the people are followers of Mohammed; both the Roman Catholic and the Greek Orthodox churches have many adherents. In official Austrian documents the people were called "Bosniaks," but they themselves would not use the name. Racially they are chiefly Croat and Serbian. Population (1953 census, preliminary), 2,843,486.

BOSPORUS. The river-like strait of the Bosphorus (or Bosphorus), is hardly less famed than the famous city of Istanbul (Constantinople), which commands its southern entrance. It lies between the Black Sea and the Sea of Marmara, and forms part of the dividing line between Europe and Asia. Treacherous currents and fogs around the north end make navigation dangerous, and a number of lighthouses have been erected.

For a distance of 18 miles the channel of the Bosphorus, from one-third of a mile to two miles broad, winds in and out through a picturesque landscape lined with villages, ancient towers and forts, and lovely palaces and summer homes of residents of Istanbul.

The word "Bosphorus" comes from Greek words meaning "ox-ford," suggested by the legend that the goddess Io swam the strait in the form of a cow (see Io).

THE WHITE RAJAH



Sir Charles Vyner Brooke was the third white rajah of Sarawak. He succeeded his father. The three savage chiefs are Kayans from the interior of his domain.

An aerial photograph of a city, likely New Orleans, showing a large, dark, irregularly shaped area in the center, possibly a lake or a large industrial site, surrounded by dense urban development. The image is in black and white and has a grainy, high-contrast appearance.

roundings Beneath and around it the Boston Peninsula stretches between Boston Bay on the east and the Charles River on the north. Wharves and piers fringe the peninsula. The bay is dotted with islands and busy with shipping. East of the State House lies the hilly land where early Boston was built. To the south west and north stretches an unbroken modern city.

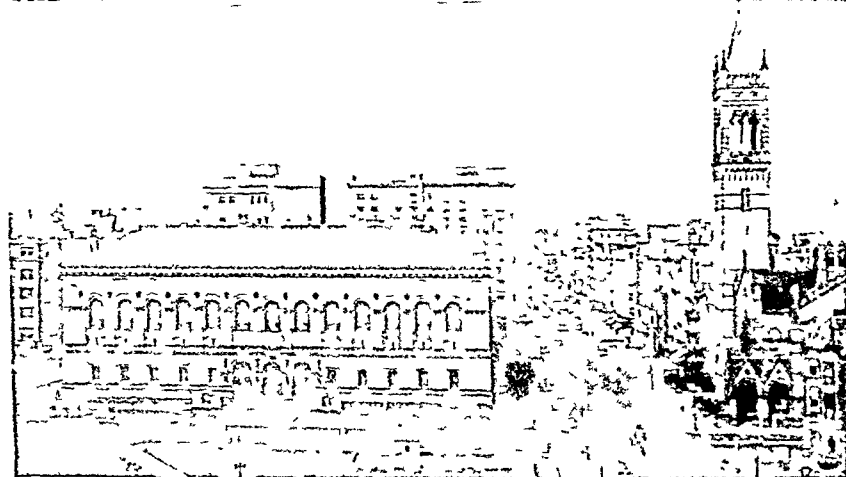
The city of Boston covers only 46 square miles of land surface. Around it lies a crescent of suburbs closely built together. The communities are independent governmental units. But those closest to Boston have entrusted metropolitan commissions with the regulation of their water supply, sewage disposal, parks, highways and certain other facilities. Sixty-five cities and towns, including Boston, situated in parts or all of five counties make up the standard metropolitan area. This densely populated area covers only a small part of Massachusetts but it contains about one half of the people of the state.

Beautiful Dwellings on Beacon Hill

Beacon Hill where the State House stands is just west of the center of old Boston. Here lived many prominent figures in American literature and politics in serene and beautiful old dwellings along the steep streets. Today you may see the house in which the

The great gilded dome of the Massachusetts State House offers a glorious view of the city and its sur-

THE FRONT OF THE FAMOUS BOSTON PUBLIC LIBRARY



The Boston Public Library, facing Copley Square, is built in Italian Renaissance style around an open court. Over the main entrance are sculptured panels by Saint-Gaudens. The doors are bronze, from designs by Daniel Chester French. Murals by Abbey, Sargent, Puvis de Chavannes, and other artists decorate the interior. At the right of the view above is the New Old South Church.

historian Parkman wrote for 20 years. In another, Thomas Bailey Aldrich wrote his 'Stories of a Bad Boy'. Others have been the homes of Motley and Prescott; Ticknor and Alcott; Pinckney and Channing; Julia Ward Howe and William Dean Howells.

To the west of the State House stretches the famous Common and the smaller Public Garden. In colonial times the 48-acre, tree-dotted Common was used for pasturing cattle. Here criminals and Quakers were executed. And here British troops drilled before the battles of Lexington and Bunker Hill. Many colonial patriots lie buried in the little Old Granary Burying Ground east of the Common, beside busy Tremont Street. In it are the graves of Samuel Sewall, Benjamin Franklin's parents, John Hancock, James Otis, and Samuel Adams.

The Charles River

As you look west and north you see the waters of the Charles River estuary. It was once called the Back Bay; now it is the Charles River basin. Across it gleam the ivy-covered buildings of Harvard University in Cambridge, the most celebrated of Boston's suburbs. The bay with its tidal marshes once dipped far south into the present city. But this part of the bay was filled in during the 19th century, and the "made land" became the fashionable Back Bay residence district. Along the river runs the wide Esplanade. A dam blocks the flow of the ocean tides and keeps the water at constant depth.

Northeast of the dam a maze of railroad tracks runs from North Station into northern New England. The

parkway in its center is adorned with the statues of famous men. It is a link in a park system that girdles the city with two rings of parks, playgrounds, and boulevards. This system includes the world-renowned Arnold Arboretum and 527-acre Franklin Park.

South of Commonwealth and parallel with it is the scarcely less famous Boylston Street. Two blocks from the Public Garden it broadens into the green triangle of Copley Square. Here stands the renowned Boston Public Library. Opposite rises stately Trinity Church, with its beautiful decorations and stained glass windows by La Farge, William Morris, and Burne-Jones. Other imposing structures adorning the square are the New Old South Church and the Copley Plaza Hotel. Boston University is a block to the west. Broad Huntington Avenue leads southwest from the square. Along and near it are such notable buildings as the Mother Church of Christian Science, Symphony Hall, the Opera House, and the Museum of Fine Arts. This Museum

stands alongside the Fenway, a charming parkway built on reclaimed mud flats. In the educational center near the Fenway are several of Boston's famed colleges and conservatories, the Boston Latin School, oldest in the country (founded in 1635), Isabella Stewart Gardner Museum, and the Massachusetts Historical Society. Circling farther around the cupola to the south and east, you see at your feet the maze of narrow crooked streets that make up the business center. Washing-

locality was open water in the days of the Revolution. Across it, Charlestown patriots saw lantern signals. Paul Revere had hung in North Church tower before he began his historic ride (*see* Revere). The other main railroad entry, South Station, lies south of the central district.

Famed Back Bay

Through the Back Bay district run many of Boston's handsomest streets and avenues. Not far south of the river, Commonwealth Avenue extends westward from the Public Garden. The green

Population—City of Boston (1950 census), 801,444; Boston metropolitan area, 2,369,986.

Area, Location—City, 46 square miles, 5 square miles of parks; metropolitan area, 1,022 square miles, 17 square miles of parks; geographic location (State House), 42° 21' N., 71° 4' W.

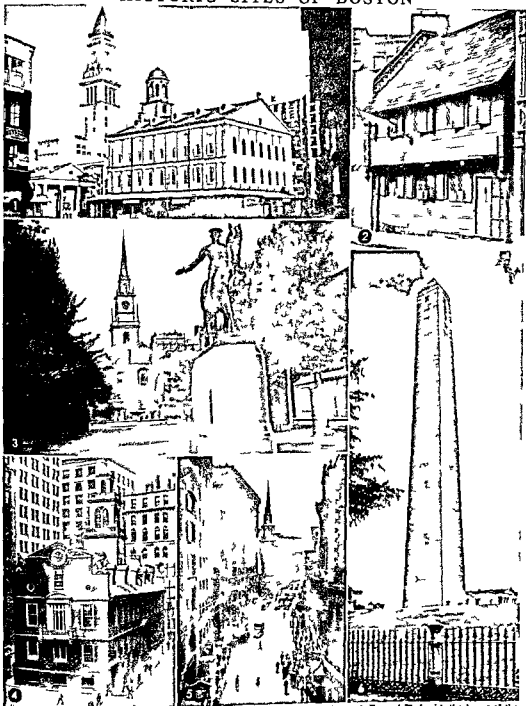
Climate—Mean temperatures, from 29° (January and February) to 72° (July); yearly, 50°. Annual rainfall, 41 inches.

Port and Shipping—About 120 miles of water front, about 260 wharves, 40 miles berthing space; from 16 to 18 million tons of shipping annually.

Schools—Public schools, city, 240, metropolitan area, about 1,100. More than 200 private schools and colleges in the metropolitan area.

Transportation (city)—Elevated, surface line, 12 miles of municipal subway.

HISTORIC SITES OF BOSTON



Some of the most interesting historic sites in and around Boston are shown here. 1. Faneuil Hall with the tower of the modern Custom House at the left. 2. The home of Paul Revere, the oldest house in Boston dating from about 1666. 3. Old North Church and a statue of Paul Revere. 4. The Old State House. 5. Old South Meeting House, almost swallowed up by busy Washington Street. 6. Bunker Hill Monument, 221 feet high, site of the famous battle in the American Revolution.

ton Street is the most congested thoroughfare in the country, and several others are so narrow that traffic is permitted in only one direction. This, one of the oldest parts of Boston, is rich in historic buildings and associations. Here is the Old State House (1713), the seat of royal government of Massachusetts during the provincial period, now a historical museum. Under its balcony took place the fateful Boston Massacre of 1770, when five persons lost their lives in an encounter with British soldiers. Not far away is Faneuil Hall (1763), the cradle of American liberty, where the patriots often met during the Revolutionary War period, and where in later times Webster, Choate, Sumner, Wendell Phillips, and Everett made the air ring with their oratory. Old South Meeting House, where Benjamin Franklin was baptized, stands amid modern office buildings that far overtop its slender wooden spire. Because many patriotic meetings were held in this old church, it became known as the "sanctuary of freedom." Tucked away in another corner is the old pillar-fronted King's Chapel (1749), where General Washington sat one day in 1789 when an oratorio was given in his honor. In the little burying ground adjoining are the graves of John Winthrop and John Cotton.

Northward, on the site of the original city—a district now crowded with people of foreign extraction—is the tower of Christ Church (also called Old North Church), the oldest church of the city (1723). From it Paul Revere is supposed to have had two lanterns hung for his famous ride. Revere's house is still standing, not far away, a little two-story building with a steep roof, almost lost among Italian shops and tenements. In Copp's Hill burial ground beyond Christ Church are the tombs of the Mathers.

Where Bunker Hill Was Fought

Across the narrow dock-lined stretch of water, spanned by many bridges, that separates the North End from Charlestown, is a plain square stone shaft rising high above the huddle of roofs. This is the Bunker Hill Monument, which commemorates one of the glorious episodes in American history. All the eastern end of the Charlestown peninsula is given over to the vast United States Navy Yard, which has stood here since 1800. At the piers or out in the open water lie scores of warships, little and big, contrasting strangely with the famous wooden frigate *Constitution*, or "Old Ironsides," as it is affectionately known. School children of the country gave their pennies to help make it a floating museum.

Such are a few of the historic scenes that fill the eye as it sweeps over the city. But however much one may like to dwell on the greatness of Boston's past, one must remember the greatness of the modern city, the capital of Massachusetts, and the metropolis of New England. Though it ranks only tenth in population, it is the third greatest financial center of the country and the third largest wholesale market. Many powerful banks, railroads, insurance companies, mining concerns, industrial enterprises, and wholesale distributing agencies make it their head-

quarters; and it has its own stock exchange. Through the port of Boston pour raw materials to feed the mills and factories of a great industrial area. The city is the largest wool market in the world, one of the largest markets for hides and skins, and a leading port of entry for raw cotton.

Industries and Education

Boston imports supply raw materials for the textile mills of all New England. Boston itself and the metropolitan area have been textile centers since colonial days. The manufacture of clothing and of textile machinery is also very important. The first skilled shoemakers came to the colony from England in 1629, and the industry was well established by 1650. Boston and its neighboring cities still produce more shoes than any other area in the world. Shoemaking machinery and leather are related products. Printing and publishing, food products, electrical equipment, and foundry and machined products are also leading industries. Boston is one of the chief fishing ports in the nation. Boston Fish Pier is the largest of its kind in the world. More than 3 million pounds have been landed in a single day, and frozen and filleted fish are shipped in immense quantities.

As a seat of education, the Boston area is unsurpassed in America. In the city are Boston University, Simmons College, Northeastern University, Harvard Medical and Dental schools, Tufts Medical and Dental schools, Emmanuel College, and the New England Conservatory of Music. The Athenaeum Library and the Boston Museum of Fine Arts are world-famous institutions. Cambridge, just across the Charles River, is the home of Harvard, Radcliffe, and the Massachusetts Institute of Technology. Wellesley and Tufts colleges are in Wellesley and Medford respectively.

The largest of the immediate suburbs is Cambridge (see Cambridge). North of it, on the south bank of the Mystic River, is Somerville, the principal meat-packing center of the state. Arlington, Medford, Everett, and Chelsea lie along the north bank of the Mystic River. Everett manufactures coke and petroleum products, oils, chemicals, and shoes. Chelsea produces shoes, paper, and elastic webbing. Medford and Arlington are attractive residential suburbs. Southeast of Chelsea is Winthrop, and northeast is Revere, both celebrated for their beach resorts. Thrusting almost into the heart of Boston from the west is Brookline, an exclusive residential suburb. Newton, west of Brookline, is the seat of Boston College and of Andover Newton Theological School. Waltham, north of Newton, is famous for its watches. On the south Boston is touched by Dedham, Milton, and Quincy. The last is famous as the home of the Adams family. Shipbuilding is its most important industry.

A Colorful Historical Background

The history of Boston is in large part the history of Massachusetts. It was founded in 1630 by Puritan settlers led by John Winthrop and was first called Trimountane, from its three hills. The name was soon changed to Boston, from the town in Lincolnshire, England, whence many of the settlers had come. The

original name survives in Tremont Street. The city was a center of Puritanism and of learning in America. Here were started the first newspapers (1690 and 1704). The same Puritan spirit which led to the punishment of heretics, Quakers and witches contributed largely to making Boston the center of opposition to the oppressive measures of the mother country in the period preceding the Revolution. The Boston Massacre, the Tea Party and the British evacuation of Boston are famous events.

In the 19th century Boston retained its leadership in educational, cultural and humanitarian lines. Many great literary men and scientists lived in or near the city among them Longfellow, Lowell, Whittier, Emerson, Hawthorne, Holmes, Agassiz, Parkman, Motley, Prescott. The city also became the center of the antislavery movement.

In 1872 the city was devastated by several fires destroying more than \$75,000,000 worth of property in the business section. In rebuilding many narrow and winding streets were widened and straightened. Boston has long been a leading city in municipal improvements. It pioneered in parks and playground movements. It built 40 miles of ship berths and one of the world's largest dry docks. The double-decked two-mile Mystic River Bridge connects Boston with Chelsea and routes north. An elevated road way to avoid downtown traffic and a by-pass highway around Boston were begun in 1930. Huge Logan International Airport completed in 1950 handles many domestic and transatlantic flights. It is built on filled land off Boston harbor near the heart of the city.

Until the middle of the 19th century Boston's population continued to be predominantly of English descent. But following the potato famine in Ireland there was a great influx of Irish to the United States and many remained in Boston, their chief port of entry. Canadians, Italians, Russians and Poles also migrated to the city in large numbers. Now the Yankee New England stock is in the minority.

BOTANICAL GARDENS AND ARBORETUMS. Both botanical gardens and arboreta are areas set aside for the growing and display of plants. The botanical garden displays out of doors or in greenhouses the principal types of plant life throughout the world. The arboretum specializes in growing trees and shrubs (woody plants) under natural conditions.

The Royal Botanic Gardens near London better known as Kew Gardens rank as the most complete in the world. Kew Gardens had their beginning about 1759 in the private garden of Princess Augusta, mother of George III. The grounds were

presented to the nation by Queen Victoria and were opened to the public in 1841.

This mecca for botanists covers 288 acres. Plants gathered from the entire world are displayed in its gardens and arboretum and in its many greenhouses. The herbarium of dried and mounted plants containing at least 6 million specimens is by far the world's largest. Four museums of economic botany contain a vast collection of fibers, timbers, drugs and food products both in the raw state and in manufactured form. Experimental research is carried on in the Jodrell Laboratory. Kew has introduced economic plants into far corners of the British Empire. Its work for example was the foundation of the plantation rubber industry.

The Jardin des Plantes in Paris was founded under Louis XIII in 1635. Its formal gardens are especially fine. This too is a great research institution. It includes in its 74 acres a natural history museum and a zoo.

In the United States the New York Botanical Garden, New York City, is notable. Founded in 1891 it now covers 230 acres. The Bronx River flows through the park, its banks covered with a virgin hemlock forest. One large building houses the laboratories, a museum, a library and an herbarium of more than 2½ million preserved plant specimens. The garden has sent out many expeditions in search of new plant material. It has described and identified for the first time more than 5,500 plants. It conducts research in plant breeding, the causes and control of plant diseases, medicinal uses of plants and antibacterial and virus-killing substances for the control of human disease. Its specialists teach graduate students of Columbia and Fordham universities and conduct popular courses in gardening and botany.

Arnold Arboretum at Jamaica Plain, a suburb of Boston, is owned by Harvard University. It was

LILAC PATH IN ARNOLD ARBORETUM



One of the world's most complete collections of lilacs borders the famous Lilac Path in the Arnold Arboretum. This arboretum, owned by Harvard University, covers 265 acres at Jamaica Plain, near Boston. It is one of the oldest in the country.

founded in 1872. Under Charles Sprague Sargent, its director for 54 years, it became one of the finest in the world. It has introduced many new ornamental plants into American gardens, and it is one of the country's largest trial grounds for such plants. Although there are no formal gardens, the flowering shrubs and trees make this a most beautiful park. In addition to the 265 acres at Jamaica Plain, the arboretum includes 150 acres at Weston, Mass., where the nurseries of experimental plantings are maintained.

The Missouri Botanical Garden has 75 acres in St. Louis and a 1,600-acre arboretum at Gray Summit.

Its orchid collection of about 20,000 plants is one of the largest in the world.

Morton Arboretum, near Lisle, Ill., west of Chicago, and the Brooklyn Botanic Garden, in Brooklyn, N.Y., are notable for their educational work with teachers and children. The Boyce Thompson Southwestern Arboretum, at Superior, Ariz., specializes in plants of semiarid climates. The Fairchild Tropical Garden, Coconut Grove, Fla., specializes in palms and the development of plants collected by Dr. David Fairchild in the South Pacific. The Montreal Botanical Garden, in Quebec, raises plants native to Quebec.

How MEN STUDY and CLASSIFY PLANTS

BOTANY. It should be understood at the outset that botany is one division of biology, or the science of living beings, and that it simply means a study of biology with plants as illustrative material. The article on Plant Life deals in detail with the most important and interesting features of this subject. Here we consider merely the technical development of the science and its several subdivisions.

Men began to study plants to discover those that were useful to them for food, or in the arts, or in medicine. The first botanists were perhaps healers and priests looking for new drugs and magic charms. Aristotle and his pupil Theophrastus had classified all plants as trees, shrubs, and herbs, and there was no further attempt to develop a scientific knowledge of plants until the 16th century. It was then that students again began to arrange plants into groups, but the groups were artificial. These attempts culminated in the famous artificial system of the Swedish botanist Linnaeus, which was published in the middle of the 18th century and in use to the middle of the 19th century.

Since the days of Linnaeus a great advance has been made in constructing what are known as natural systems of classification. These attempt to put together those plants which are really related. As a consequence, the subject of classification, or *taxonomy* as it is called, is now upon a very substantial basis. Taxonomy is the oldest phase of botany and to many it continues to represent the whole subject. It is not unusual to meet people who think of botany as the analysis of flowers. Of course, taxonomy includes the classification of flowering plants, but it includes a classification of all other plants as well.

What the Microscope Did for Botany

During the latter part of the 18th century a new phase of botany began to be developed, which deals with the structure and development of plants and their organs. This study became possible only through the invention and gradual improvement of the microscope, by means of which the minute structures of plants could be investigated. At first botanists interested themselves merely in the structure of mature plant bodies. As there gradually developed the knowledge of the cell as the basis of living bodies, the field of *plant anatomy* came into view. This

has to do with the various cell aggregates known as "tissues" which enter into the plant body. Still later, botanists began to be more interested in the way in which the tissues are related to one another to form the plant body and its organs, and the science of *plant morphology* began to exist. This last subject for a time contented itself with the study of the forms of plants and their organs, but presently passed into the more important phase of studying the gradual development of plants and of their organs, subjects which are often called *embryology* and *organology*. Morphology not merely studies the development of structures, but it studies the relationships of plants which are thus revealed, and hence is interested in what is known as *phylogeny*—that is, the ancestral history of plant groups.

Plants at Work

During the time that plant morphology was coming to the front, another study of plants was being developed. This deals with their life processes, or the plants at work. A good many botanists cared not so much for the structure of plants as for the activities of plants, and *plant physiology* began to assume importance. This subject developed with exceeding rapidity during the 19th century. Like animal physiology, it is certainly one of the most important studies which can be taken of life processes.

During recent years still another field of botany has come prominently forward. This deals with plants in relation to their environment and is known as *ecology*. Under this phase the necessary relations of plants and their organs to light, heat, soil, temperature, and so on, are studied, and also the interesting communities known as "plant societies."

The most recent phase of botany is *plant breeding*. This and animal breeding are an outgrowth of *genetics*, the scientific study of heredity. The plant breeder, by hybridizing, selecting, and pedigreeing, is able to produce new and valuable types of plants.

The foregoing may be taken to represent the principal fields of botanical activity today, but there are other botanical subjects which are of a more specialized nature. For example, *plant pathology* deals with diseases of plants; *paleobotany*, with fossil plants; *economic botany*, with plants in relation to the interests of man; *forestry*, with the problems of proper

STUDYING THE RISE OF PLANT LIFE



These children are studying a table exhibit which illustrates the succession of plant life from the lowliest forms growing on bare rock to a climax forest. The plants that prepare the way for all others are the lichens. They break down the rock and so help

to make soil. After them come the mosses. They make still more soil and provide organic plant matters out of which the higher forms can grow—the herbs, shrubs and flowering plants. The climax of plant life is the forest.

cultivation and use of forests. Still further subdivisions of the general subject are common. A bacteriologist is one whose attention is devoted to the study of bacteria; those minute microscopic plants which cause many diseases and are important in other ways. The phycologist studies the algae; the mycologist studies the fungi; the bryologist the mosses; and so on.

A real elementary knowledge of botany should include something from all the principal divisions of the subject. For example, a beginning student should know how plants must relate themselves to

their surroundings in order to live (ecology). He should know how plants make food and use it; how they respond to stimuli and how they reproduce (physiology). He should also learn something of the essential structures of the great groups so that he may know the make-up of a toadstool, moss, fern, flowering plant, and other forms (morphology). In addition, he should have some general knowledge as to how plants are put into great natural groups or families, and he should be able to discover the names of the most important plants of his vicinity (taxonomy).

REFERENCE-OUTLINE FOR STUDY OF BOTANY

Readily understood material on life habits of plants and helpful adaptations of body structure is listed in the Reference Outline for Nature Study. Physical and chemical aspects of plant life processes are given in the Reference Outline for Biology. This outline covers botany as a science; important special phases of plant structure and life; relations between plants and mankind; and the scientific classification of plants.

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Note Flowerless plants (called *cryptogams*, from Greek words meaning "hidden marriage") do not produce seeds. They comprise *thallophytes*, *bryophytes*, and *pteridophytes*. (See scientific classification of plants below.) Flowering, seed-bearing plants are called *phanerogams* (meaning "visible marriage").

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Note: This outline classifies plants by subkingdoms, phyla, subphyla, classes, and subclasses. In each grouping, rank in subdivision is stated once, thus *Phylum Phycophyta*. Successive names of the same rank follow without the rank name, at the same indentation from the left-hand margin.

Subkingdom Thallophyta

Plants with "thallus" bodies, lacking true roots and leaves, reproduce by simple division or by spores

Phylum Phycophyta (thallophytes having chlorophyll): algae A-152-4, P-288. Algae are subdivided according to coloring matter, into classes:

Class Myxophyceae (blue-green algae)

Note: Some scientists believe that blue-green algae and bacteria are neither plant nor animal but should constitute a separate kingdom. See page L-225

Chlorophyceae (green algae) such as pond scums: sea lettuce L-224b, picture S-94

Phaeophyceae (brown algae): seaweed S-94-5; diatoms D-82, pictures M-233, A-236b, L-224b

Rhodophyceae (red algae) A-154

Mycophyta (thallophytes without chlorophyll): fungi F-316

Class Myxomycetes: slime molds S-199

Schizomycetes (fission fungi, single-celled body): bacteria B-15

Phycomycetes (algaelike fungi): water molds, often parasitic on fishes; downy mildews, black molds M-248

Ascomycetes (fungi-bearing spores in sacks): yeast Y-336; morels M-457; truffles M-457

Basidiomycetes (fungi-bearing spores on structure called "basidium"): rusts and smuts R-297; mushrooms M-455-7

Note: Lichens (L-220) are combinations of a fungus and an alga living together in a partnership that is mutually helpful.

Subkingdom Embryophyta

Separate stem, root, and leaf structures; develop embryos in parent body, either in alternate generations or every generation

Phylum Bryophyta (primitive leaves, stems, and root-like rhizoids): mosses and their allies P-289

Note: Reproduction on occurs by alternation of generations the gametophyte (sexual generation) being the conspicuous form

Class Hepaticae liverworts L-278 green flat creeping (thalloid) body found growing in moist locations spore case opens by splitting
Musc. mosses M-404-6 spore case has a lid
Pteridophyta (true roots stems and leaves and a vascular system of vessels for conducting sap through the plant) ferns and their allies P-289

Note: Reproduction is by alternation of generations but the sporophyte (asexual generation) is the conspicuous form

Class Filicinae true ferns F-52-4
Equisetaceae horsetails or scouring rushes R-200, F-54 P-239
Lycopodiaceae club mosses ground pine candy tuft etc F-54 P-239

Spermatophyta (seed bearing plants) P-289 S-96 See also Note to reproductive processes above

Subphylum Gymnospermoe (naked seed cone-bearing plants cycads and conifers) P-289 235-6 F-156 S-97 cycad T-184 185 ginkgo G-103 T-184 185 arborescences A-296 cedar C-158-9 fir F-72 juniper J-364-5 pine P-257 9 spruce S-358-9

Angiospermoe (enclosed seeds flowers) P-289 296 S-97 98 flowers F-168 184-6 fruits F-306

Class Monocotyledonae (seeds with one cotyledon or seed leaf leaves have parallel veins) S-98 diagrams S-97 L-152 grasses (including bamboo) and grains G-166-7 B-42-3 iris I-232 color picture I-233 lily L-242-3 palm P-47-50

Dicotyledonae (seeds have two cotyledons leaves have network veins) S-98 picture S-97 L-152

Subclass Archichlamydeae (flowers have no corolla or one of separate petals) willow W-142 oak O-319 walnut W-5 beech B-101 pink family P-259 buttercup family B-364½ water lily W-6½ poppy P-370 rose family R-230 pictures R-231 bean family B-84 and others See also Legumines in Fact-Index

Sympteciae (flowers have corollas in which the petals are united often forming a tube) heath family H-320 primrose family P-410 gentian family G-33 mint family M-291 nightshade family N-237 composites—daisy D-5 sunflower S-454 aster A-425 goldenrod G-135 and others

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BOURBON HOUSE OF Intrigues and wars marriages and assassinations carried the autocratic house of Bourbon founded in the late 9th century by doughty Adhémar first baron of Bourbonnais to the thrones of France Spain and part of Italy The rising tide of republicanism swept the last of the family from power more than a thousand years later when gay sport-loving King Alfonso XIII left Spain after a bloodless revolution on April 14 1931

Henry IV, with his white-plumed helmet flashing before his victorious troops gained the throne of France in 1590 (see Henry Kings of France) His

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successors the Louis (see Louis Kings of France) ruled the French with ever growing arrogance until the Revolution brought weak Louis XVI and his frivolous queen Marie Antoinette to the guillotine Restored to the throne after Napoleon fell the French line ended with the abdication of Louis Philippe in 1848 Bourbon rule in Naples and Parma ended when their lands united with Italy in 1860

The Spanish line began its 200-year reign when Louis XIV placed his grandson Philip V on the throne of Spain in 1700 at the cost of the frightful War of the Spanish Succession.

BOWLING. From the ancient German game of "kegels" has developed one of America's most popular sports—bowling or "tenpins." Each year about 20 million people bowl, more than take part in any other indoor sport. About one third of the bowlers are women.

The game is played on a smooth wooden surface called an *alley*, between 41 and 42 inches wide. At one end of the alley 10 wooden pins stand in the shape of a triangle with their centers 12 inches apart. Each pin is numbered (see diagram). At the other end of the alley is the bowling or *foul line*, which the player must not cross. From the foul line to the Number 1 pin at the apex of the triangle the distance is 60 feet. A *gutter*, $8\frac{1}{2}$ to $9\frac{1}{2}$ inches wide, extends along each side of the alley. The bowler rolls a ball made of hard rubber down the alley in an effort to knock down all the pins.

Several varieties of bowling are played in the United States. The standard game is played with "bottle" pins 15 inches high and $11\frac{5}{8}$ inches around their largest part. The balls are 27 inches or less around the middle and have finger holes to give a firm, but not cramped, grip.

The players alternately roll ten innings or *frames* of two balls each. If a player in any frame knocks down all the pins with his first ball, he makes a *strike*. His score for that frame will be 10, plus the number of pins he knocks down with the next two balls he rolls. Thus if a bowler makes a strike with each of his first three throws his score for the first frame would be 30. A *spare* is scored when the player knocks down all the pins with the two balls of any frame. It counts ten plus the total made with the first ball he rolls in the next frame. Without a strike or spare, the score of any frame is simply the actual number of pins knocked down. A spare in the last frame calls for an extra ball to determine the score; a strike, two extra balls.

A perfect score is 300. It is obtained by rolling ten successive strikes plus two additional strikes made with the two extra balls in the last frame. In scoring, a strike is indicated by an "X," and a spare by a \backslash .

The History of Bowling and Its Many Varieties

The German game of "kegels" consisted of rolling stones at a group of war clubs called kegels. (Bowlers are still sometimes referred to as "keglers.") A vari-

AIMING THE BALL AT THE TENPINS



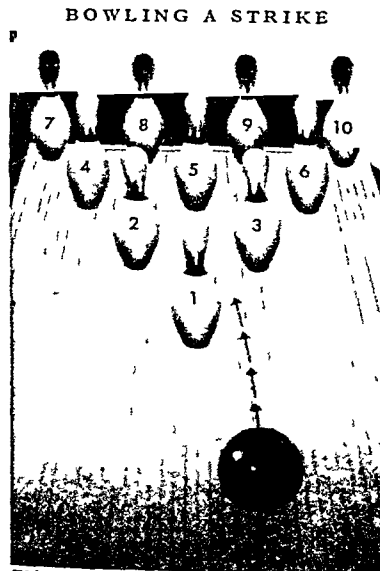
The bowler in this picture has just released the ball. Notice that the right wrist and arm are held almost straight, with the body bent forward from the waist. Most bowlers impart a spin to the ball as they release it.

ation of this game, played with nine pins, was introduced into the United States about 1800. Later a tenth pin was added and the popularity of the game grew rapidly during the 1920's. The American Bowling Congress now governs all official men's matches; women's matches are ruled by the Woman's International Bowling Congress.

"Duck pins" is played with smaller 'bottle-shaped' pins and with balls no more than five inches high. The same-sized ball is used in "candle pins," but the pins are taller and more nearly cylindrical. A slightly smaller ball is used in "New England candle pins," and fallen pins or *dead-wood* are allowed to remain in the alley. The standard scoring method is used in all these games.

"Ninepins" is played without the No. 1 pin.

The name *bowling* may have developed from the English game of "bowls," played on a lawn. Players roll wooden balls on a 40-yard course toward a white earthenware ball called the "jack." The player or team with the most balls nearest the jack wins.



This drawing shows the ball curving into the "strike pocket" between the No. 1 and No. 3 pins. A spinning ball that curves or "hooks" scatters the pins better than a straight ball.

SKILL and STRATEGY in the RING

BOXING Almost every boy enjoys the sport of boxing. Youngsters of all ages like to put on the gloves and box with other boys of their own weight and size. Boxing is simply the art of hitting an opponent and avoiding being struck in return. Padded gloves soften the blows and prevent injury.

Boxing provides many benefits. It helps to build up self-confidence by teaching a boy how to defend himself (it is often called the manly art of self-defense). A good boxer learns how to remain calm and alert even in a hard fight. Boxing is an excellent exercise calling on almost all the muscles in the body. It develops co-ordination by teaching the muscles and the brain to work together.

The best time to learn boxing is early in boyhood. The gymnasium floor or any open

space indoors or out will serve as a boxing ring. The only equipment needed is two pairs of well padded gloves. Friendly sparring matches will develop arm and body tactics and footwork. Later on a punching bag can be used to improve timing.

The Ring and the Rules of Boxing

Boxing matches take place in what is known as a ring. It is really a square platform (often called the squared circle) that is padded and covered with canvas. The ring, which is from 18 to 22 feet square, is formed of posts and ropes set at least two feet in from the edge of the platform. Each fighter has his own corner diagonally across from his opponent's. The other two corners are called neutral.

Most of the regulations which govern boxing today are based on rules drawn up about 1865 by the eighth marquis of Queensberry, an English patron of the sport. These rules require bouts to be divided into three-minute periods or rounds with one minute of rest between. (High school boxers fight one-minute rounds; college boxers, two-minute rounds.) Amateur bouts usually consist of three rounds; professional bouts vary from 4 rounds on up with 15 rounds the normal distance for championship fights. The gloves vary in weight—6 to 8 ounces for professional boxers, 10 to 14 ounces for amateurs.

To make contests fair, boxers are classified according to their weights. The upper weight limit for each class is as follows: flyweight 112 pounds; bantamweight 118; featherweight 126; lightweight 135; welterweight 147; middleweight 160; light heavyweight 175; heavyweight unlimited. Three lighter



Here a middleweight sends a hard left hook to his opponent's face. Notice how he has stepped forward with his left foot to throw the weight of his body behind the punch. His right hand is cocked ready to follow through with another blow or to block.

weights are used for high school boxers: gnatsweight 85; mosquito weight 92; and flea weight 100.

Boxing rules require both fighters to engage in a fair stand-up match with no wrestling or gouging. All blows must be struck with the gloved fists and hitting below the belt is forbidden. A fighter who breaks these rules is guilty of a foul. He may be punished with the loss of the round or he may be disqualified and his opponent awarded the fight.

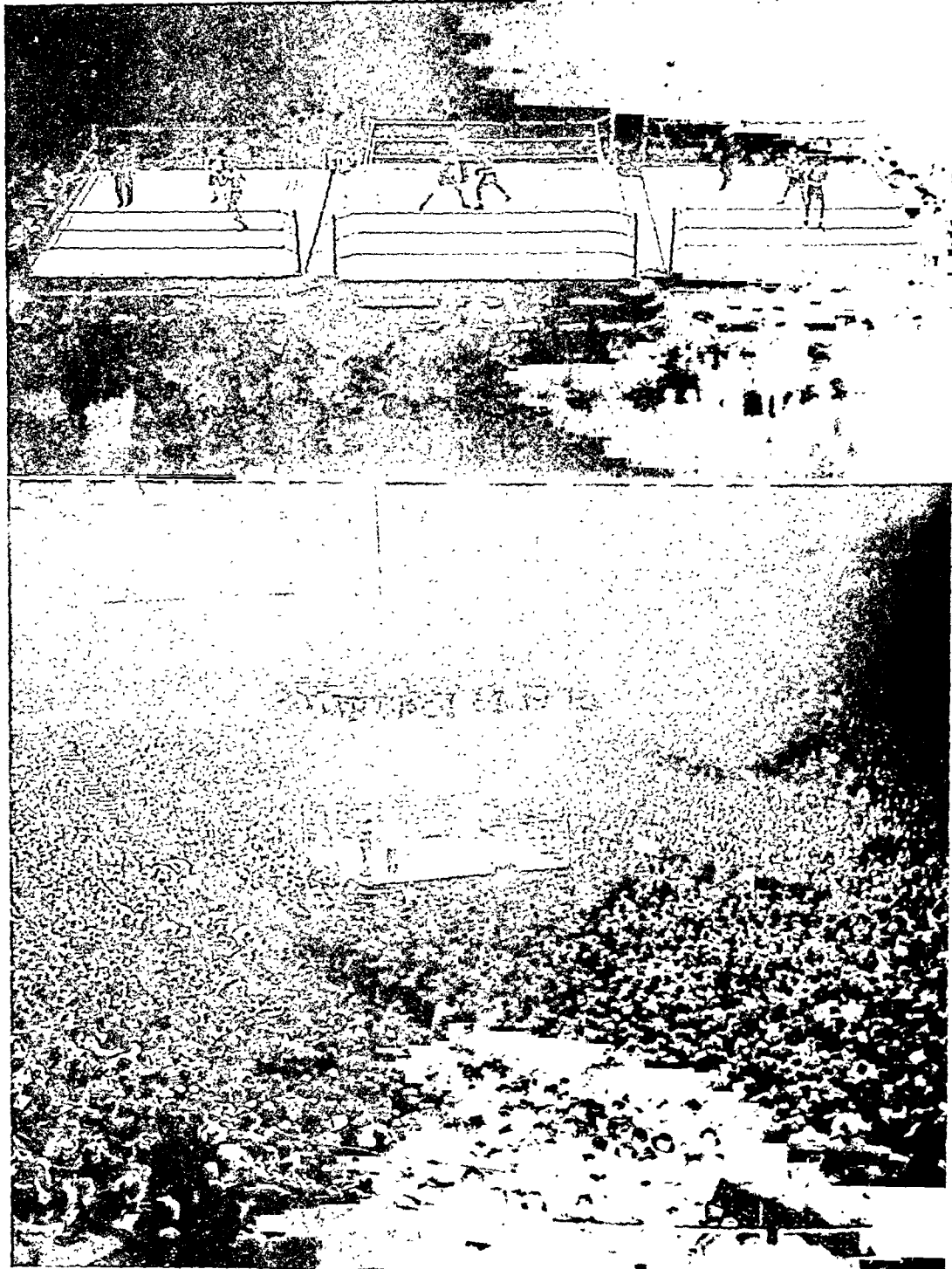
Three Ways of Winning a Bout

If a fighter falls or is knocked down by his opponent, he must get to his feet within ten seconds. The referee counts seconds aloud as long as the fighter remains down. Some states require a boxer to 'take' a count of eight if he has been knocked down. If the referee reaches the number ten, he declares a knockout (KO). Sometimes a fighter will be hopelessly beaten without being counted out. The referee may then award the bout to his opponent on a technical knockout (TKO).

The bout is decided on points if neither contestant has suffered a knockout or a technical knockout or has been disqualified by a foul. Points are scored for the number of blows landed for a clever defense and for aggressiveness. The decision is rendered by a majority vote of the referee and two boxing judges on the basis of total points scored.

Right-handed boxers usually fight from an orthodox stance. This means putting the left foot slightly ahead of the right with both feet spread apart and the weight of the body evenly distributed on both. This position enables the boxer to move quickly in any

FIGHTING FOR FAME IN THE GOLDEN GLOVES



Each year amateur boxers from all over the Midwest battle their way through the Chicago Golden Gloves tournament before capacity crowds in the Chicago Stadium. At top, in three action-filled rings, winners of local tournaments meet in elimination bouts. The four winners in each of the eight weight divisions then compete in the finals (bottom). The Chicago champions later box the New York finalists for the national title. The most famous Golden Glove star to turn professional was Joe Louis.

direction. The left arm is partly extended to the front. The right arm is held close to the body to guard the stomach and jaw. Left-handed boxers stand with the right foot and right arm forward.

The chief points of attack are the tip of the jaw, the spot just below the ear, and the solar plexus or midsection of the body. A solid punch delivered to one of these points often results in a knockout. Even though such a blow may end the fight, it does no serious harm and the boxer suffers no ill effects.

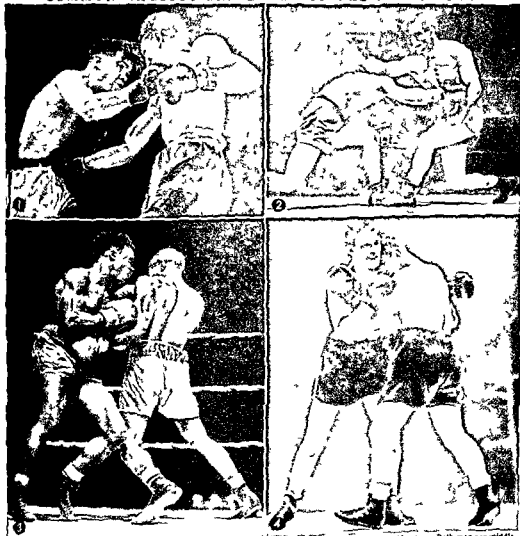
The Technique of Boxing

A good offense is usually built around the four recognized classes of punches—jab, straight blow, hook

and uppercut. The *jab* is a sharp light punch delivered by straightening out the bent arm. Although not a knockout blow, the jab can be used effectively to harass an opponent and to keep him off balance. A *straight punch* may carry the weight of the body behind it and will result in a knockout if it is landed in a vital spot. Such a blow is often delivered with the right hand after a left jab.

The *hook*, either left or right, is a swinging blow, aimed to slip by the opponent's guard. The *uppercut* is a blow directed upward, usually aimed at the point of the jaw or the midsection. When delivered with full power either punch can be a knockout blow.

COMMON TACTICS AND BLOWS OF THE PRIZE RING



1 The boxer on the left has hooked a right to the jaw while his opponent has countered with a right to the midsection. Both men are middleweights. 2 In this match between two featherweight boxers the man on the left has hooked a right to the jaw while the man on the right has countered with a right to the midsection. 3 Here is a bitter clinch between two Golden Gloves boxers in the lightweight division. Short sharp blows of this kind pile up important points. 4 These two middleweights are tied up in a clinch giving each a moment's rest.

The defense also may be built around several basic maneuvers. *Blocking* is parrying with the glove, forearm, elbow, or shoulder to deflect the opponent's punches. *Slipping*, which depends on fast footwork, consists of stepping aside and making the rival miss.

Another trick is to *roll with the punch*, that is, to soften the effects of a blow by moving in the same direction as it is aimed. *Ducking* is bobbing down so that the blow goes over the head. *Clinching*, when done legally, ties up the opponent's arms and gives the boxer an opportunity to rest.

Other maneuvers, both on offense and defense, add to a boxer's skill. One is *feinting*, or bluffing with one hand preparatory to delivering a blow with the other. To *lead* is to open an attack, usually with a left jab. *Countering* is to throw a hard punch at the opponent at the exact moment that he "leads off."

Opportunities for Amateurs

In high schools and colleges, boxing has been popular chiefly as an intramural sport. About 25 colleges have varsity teams competing with one another in dual meets and in the annual tournament sponsored by the National Collegiate Athletic Association (NCAA).

Most amateur boxers in the United States are governed by the Amateur Athletic Union (AAU), which conducts a nation-wide tournament each year. Another popular amateur tournament is the Golden Gloves, originated by the *Chicago Tribune* and *New York Daily News* in 1928. Each year national Golden Gloves champions are selected from a field of more than 30,000 contestants. International bouts between American and European champions were halted by the second World War but were resumed in 1947. Since 1904 amateur boxers have also competed in the Olympic Games.

Many boxers have turned professional after successful amateur careers.

Professional boxing rules vary slightly from one state to another but most states abide by the laws of the National Boxing Association. A number of foreign nations are also members of the NBA.

The History of Boxing

Boxing played an important part in the holiday celebrations of ancient Greece and Rome. These early

bouts were noted chiefly for their brutality. Boxers' fists were wrapped in leather thongs which were studded with bits of metal or metal spikes (called a *cestus*). The bouts usually ended only when one fighter killed his opponent. Just before the Christian Era

a Roman emperor banned all types of fighting with the fists. Boxing as a sport, then disappeared from history until it was revived in England in the 1700's.

The first man to popularize boxing with bare knuckles was James Figg of England. Between 1719 and 1730 he defeated all challengers and won acclaim as the first boxing champion. At this time the sport had few regulations. The contestants merely battled without rest until one man had definitely won. But in 1745 Jack Boughton devised the London Prize Ring rules which were later amended to form the Revised London Prize Ring rules. These regulations governed all succeeding bare-knuckle fights.

Under the London Prize Ring rules, bouts were divided into rounds which ended only when one of the boxers fell or was knocked to the ground. If the fallen man was unable to resume the contest in 30 seconds the referee awarded the bout to his opponent. The referee, however, had no power to stop the boxers from kicking, wrestling, or gouging, and these maneuvers usually played an important part in every fight. Most matches lasted

until one of the contestants was badly beaten.

In an effort to improve the sport, the Marquis of Queensberry framed the set of rules which still bears his name. The new regulations, first used in English boxing matches about 1872, soon replaced the old rules in all bouts.

Boxing in the United States

The first boxing matches in the United States were bare-knuckle bouts fought under the London Prize Ring rules. Such bouts

were illegal and the battles usually took place in isolated spots away from the police. The matches drew only small crowds, however, for the rough-and-tumble tactics of the bare-knuckle fighters found little favor with the public.

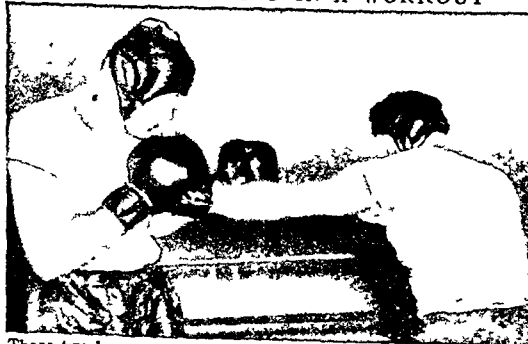
The man who did the most to improve the standing of the sport was John L. Sullivan, whose name has

DEVELOPING PUNCHING POWER



Here a professional boxer hammers a punching bag to develop his timing and hitting power. For every minute of actual fighting a boxer must spend hours in training.

BLOCKING A LEFT IN A WORKOUT



These two boxers are preparing for a bout by sparring with each other. Notice how the man on the left blocks a blow with his right glove. In training bouts, boxers wear head guards and heavy gloves (16 ounces) as shown here.

THREE OF THE MOST FAMOUS HEAVYWEIGHT CHAMPIONS



At the left is John L. Sullivan after he won the championship from Paddy Ryan in 1882. He never lost the bare-knuckle title, but he lost to Corbett (1892) in a fight with gloves. Next is Jack Dempsey, the Manassas, Colo. Mauler, who drew the first million-dollar crowd (1921). At the right is Joe Louis, the Brown Bomber. He held the title longer than any other champion.

become almost legendary in boxing history. In 1882 he defeated Paddy Ryan to win the undisputed bare-knuckle championship of the world. Sullivan then temporarily abandoned bare-knuckle fighting and toured the country fighting all challengers under the Queensberry rules. Spectators welcomed these well regulated matches fought with gloves and the popularity of the sport rose rapidly. Sullivan returned to bare-knuckle fighting several times to defend his crown, but after 1889 there were no contenders for the London Prize Ring title. In all his career Sullivan never lost a bare-knuckle bout.

The Rise and Fall of the Champions

In 1892 at New Orleans Sullivan fought James J. Corbett for the world's heavyweight championship under the Queensberry rules. Corbett's footwork and boxing skill proved superior to Sullivan's and in the 21st round he won on a knockout. Five years later Corbett lost the title to Bob Fitzsimmons, who featured a solar plexus' punch. Fitzsimmons, a former middleweight champion, was knocked out in 1899 by James J. Jeffries in his first defense of the title.

After defeating all challengers Jeffries retired in 1905. The following year Tommy Burns (real name Noah Brusso) claimed the championship on a 20-round decision over Marvin Hart. Burns lost the title to Jack Johnson at Sydney, Australia, in 1908. The championship remained in dispute however until Jeffries came out of retirement in 1910 to fight Johnson at Reno, Nev. Jeffries had never been defeated in a professional bout, but he was no match for the colorful Negro boxer and was knocked out in the 15th round. Johnson went on to defeat all chal-

lengers until in 1915 at Havana, Cuba, he was defeated by Jess Willard, a powerful ex-cowboy who stood 6 feet 7 inches and weighed over 250 pounds.

In 1919 Tex Rickard became boxing promoter for Madison Square Garden in New York City and under his direction boxing reached its first great popularity. One of his promotions was a championship fight between the giant Willard and Jack Dempsey at Toledo, Ohio, July 4, 1919. Willard was a heavy favorite to win, but Dempsey slipped through the champion's guard and knocked him to the floor seven times in the first three minutes. Battered and bleeding, Willard lasted only three rounds.

Boxing Becomes a Big Business

In 1921 Dempsey defeated Georges Carpentier of France in four rounds and two years later he knocked out Luis Angelo Firpo of Argentina in the second round. For the first time in ring history fans paid over a million dollars to see each of these bouts. The new interest in the sport grew out of the first World War when the United States Army taught boxing as part of its training program.

In 1926 Dempsey lost the title on a 10-round decision to Gene Tunney, a cool scientific puncher who was a master of defensive tactics. The following year in a return match at Chicago Dempsey knocked Tunney down in the 7th round for a count of 9. Many spectators thought that the count actually could have reached 14. But Dempsey hesitated over the fallen champion instead of immediately moving to a neutral corner as provided by the rules. The referee refused to declare a knockout and Tunney rallied to retain his crown on a 10-round decision.

HEAVYWEIGHT CHAMPIONS OF THE WORLD

| NAME AND CHAMPIONSHIP YEARS | WON TITLE FROM | LOST TITLE TO |
|---|-------------------|--------------------|
| Sullivan, John L. (<i>Last bare-knuckle champion</i>) (1882-92) | Paddy Ryan | James J. Corbett |
| Corbett, James J. (1892-97) | John L. Sullivan | Bob Fitzsimmons |
| Fitzsimmons, Bob (1897-99) | James J. Corbett | James J. Jeffries |
| Jeffries, James J. (1899-1905) | Bob Fitzsimmons | Resigned title |
| Burns, Tommy (1905-08) | (Title Vacant) | Jack Johnson |
| Johnson, Jack (1905-15) | Tommy Burns | Jess Willard |
| Willard, Jess (1915-19) | Jack Johnson | Jack Dempsey |
| Dempsey, Jack (1919-26) | Jess Willard | Gene Tunney |
| Tunney, Gene (1926-28) | Jack Dempsey | Retired undefeated |
| Schmeling, Max (1930-32) | (Title Vacant) | Jack Sharkey |
| Sharkey, Jack (1932-33) | Max Schmeling | Primo Carnera |
| Carnera, Primo (1933-34) | Jack Sharkey | Max Baer |
| Baer, Max (1934-35) | Primo Carnera | James J. Braddock |
| Braddock, James J. (1935-37) | Max Baer | Joe Louis |
| Louis, Joe (1937-49) | James J. Braddock | Resigned title |
| Charles, Ezzard (1949-51) | (Title Vacant) | Joe Walcott |
| Walcott, Joe (1951-52) | Ezzard Charles | Rocky Marciano |
| Marciano, Rocky (1952) | Joe Walcott | |

Tunney defended his title once more and then in 1928 retired as the first undefeated heavyweight champion of modern times. In 1930 Jack Sharkey of Boston and Max Schmeling of Germany were matched for the title. The German won on a foul and was "elected" champion despite considerable protest. Sharkey won a return bout in 1932.

A quick succession of champions followed. Sharkey lost the title in 1933 in his first defense to Primo Carnera of Italy. Carnera then lost the crown a year later to Max Baer. In 1935 Baer was knocked out by James J. Braddock.

The apparent low caliber of these heavyweight champions caused many fans to lose interest in boxing. Then a new stimulus to the sport was provided by Joe Louis (real name Joe Louis Barrow), whose terrific punching power earned him the name "Brown Bomber." Louis, a former Golden Gloves fighter, turned professional in 1934 and quickly built a string of 27 consecutive victories. His spectacular triumphs revived interest in boxing.

Louis' rise was momentarily stopped in 1936 by a surprise defeat at the hands of Max Schmeling. Louis, however, came back with seven impressive wins and in 1937 knocked out James J. Braddock

to become the 'second Negro to hold the heavyweight championship.

Louis' Records and Retirement

The Brown Bomber broke more records than any fighter in ring history. At the age of 23 he was the youngest man to win the heavyweight title. He knocked out 21 challengers while defending his crown 25 times. Each figure was an all-time record. He also held the title longer than any other heavyweight.

Louis retired in 1949. The same year Ezzard Charles was named champion when he defeated the veteran "Jersey Joe" Walcott. Charles clinched his claim to the crown in 1950 by defeating Louis, who was attempting a comeback. In 1951, however, Charles lost the title to the 37-year-old Walcott.

On Sept. 23, 1952, boxing got its third heavyweight champion in three years. The new titleholder was 28-year-old Rocky Marciano, who knocked out Walcott in the 13th round at Philadelphia. It was Marciano's 43d consecutive ring victory as a professional.

Ring Champions of Other Divisions

Many famous boxers fought in the lighter weight divisions. One of these was Henry Armstrong. In 1937-38 he won the featherweight, lightweight, and welterweight crowns to become the first man ever to hold three world's championships at the same time.

Other great fighters and their achievements were: Jack Dempsey, middleweight champion, 1884-91, often called "The Nonpareil"; Johnny Kilbane, featherweight champion, 1912-23, defended title successfully for 11 years; Benny Leonard, lightweight champion,

1917-24, retired undefeated; Harry Greb, middleweight champion, 1923-26, lost only nine out of 288 bouts.

BOYCOTT. A group of people may express their disapproval of a person, a business, or another group by means of a "boycott." They act together in refusing to have any dealings with the object of their boycott. The commonest form is that used by a labor union against an employer. The members of the union will not work for him or buy from or sell to him. Such action is known as a *primary boycott*. If other unions agree to take sympathy action it is a *secondary boycott*. The Labor Management Act of 1947 (Taft-Hartley Act) banned all secondary boycotts as injuring innocent parties and interfering with free trade.

Nations sometimes attempt to enforce their will by using the boycott against other nations. Consumers also have employed this weapon as a protest against prices or labor conditions.

The word "boycott" originated in Ireland about 1880. The Irish Land League agreed that any landlord or agent who blocked land reform should be "isolated from his kind" (see Parnell). The first object of this pact was Charles C. Boycott, agent in County Mayo for the estates of an Irish lord. From his name we get "boycott."

FUN and ADVENTURE in SCOUTING

BOY SCOUTS OF AMERICA Almost every boy wants to go hiking in the woods and to sleep under a star or under the stars. He is eager to live the free and adventurous life of the woodsman and the explorer. He wants to paddle a canoe down a quiet stream, cook his own meals and tell stories around an evening campfire. Back at home he likes to make things and prepare for days in the outdoors. Best of all, he likes to have fun and to earn badges along with his neighborhood friends.



While he is on his Scout patrol exploring a path through deep woods. They will identify birds and trees as they go and may even be the thrill of spotting a deer.

Today nearly two million boys are enjoying these experiences as members of the Boy Scouts of America. Any boy who has reached his 11th birthday can join the Boy Scouts by simply applying to a near-by troop. If he is 8, 9, or 10 he can take part in home and neighborhood activities in a Cub Scout den. A young man of 14 or more can be a Senior Scout. In this group he can choose to be

an Explorer Scout, Sea Scout, or Air Scout. Boys who live too far away to attend regular meetings can become Lone Scouts.

How Scout Troops Are Formed

Scout troops are sponsored by different community organizations such as churches, schools, Granges, and American Legion posts. The sponsors provide the meeting place and help the Scouts in other ways.

In charge of a troop is the *scoutmaster*. He is a man who understands boys and enjoys doing things with them. He is trained in scouting and he knows how to make the meetings and hikes interesting and often exciting. Usually he has several assistants. The adult leaders and helpers are called *scouters*.

When a boy joins a troop, he becomes a member of a *patrol*. Each troop usually has about four patrols made up of boys who become close friends. At the head of each patrol is a *patrol leader*. The patrol has its own meetings, sometimes in its own patrol room. The boys go on hikes together, form teams in troop contests, and help each other to pass tests.

The Distinctive Scout Uniform

As soon as a boy becomes a Tenderfoot, he may wear the Scout uniform. It consists of khaki trousers and shirt with a colored neckerchief worn instead of a necktie. The Scout may wear either an overseas type cap or a campaign hat and either long trousers or breeches and stockings. In summer Scouts may wear shorts and a short-sleeved collarless shirt.

On his upper sleeves the Scout wears his troop number, patrol and community emblems. He also

TUNES AND TALES AROUND THE FIRE



Scouts, sea scouts, and a scout around the campfire on the day to a happy close to their Boy Scout year. The surrounding woods are hushed with their songs and cheer.

A BUSY CAMP DAY BEGINS EARLY



In camp, Scouts wake up with a big yawn but feel great after a restful night's sleep. They build a fire in their Scout version of a stove and start cooking breakfast. Afterward they clean up and make sure the fire is out.

wears emblems showing his rank in the troop and his rank in scouting. A numeral mounted on a star, worn over the breast pocket, shows his years in scouting.

Advancing in Scouting

The heart of all scouting activities is the advancement plan. Through it, the Scout learns how to take care of himself anywhere and how to help others in many ways. He also wins higher ranks, with insignia which all Scouts recognize as badges of achievement.

There are four stages of advancement in each rank. First the Scout *learns*—by himself, or with the aid of leaders and older Scouts, and special instructors, when necessary. Then he is *examined* by his leaders on what he has learned. This step is not like a school test. A Scout shows what he learns by performing the test under real conditions.

Next comes the *review*. Before a Board of Review, the Scout describes what he did to pass his tests. In this way the board makes sure that high scouting standards are being observed. At last comes the *award*. The Scout appears at a Court of Honor and is awarded the badge he has earned.

Climbing to First Class

The first three ranks in scouting are Tenderfoot, Second Class, and First Class. For each of these the Scout must pass tests in *scout spirit*, *scout participation*, and *scoutercraft*.

To become a Tenderfoot, the boy must demonstrate Scout spirit by learning the ideals and traditions of scouting. For Scout participation, he learns about his troop, his community, and his country's history and flag. For scoutercraft, the boy must know simple first aid, conservation of nature, and knots.

To reach Second Class, a boy must practise the ideals of Scout spirit and participation. He must maintain a savings plan to show he is learning thrift. The high point of his scoutercraft requirement is a five-mile hike.

Before the hike, he must pass tests in safety and health precautions and in proper hike clothing. He must be able to use a compass, measure distance by pacing, and read a map. After showing he can use a knife and ax and can build a fire, he must cook a meal outdoors. As final preparation, he learns to follow a trail and find evidences of wild life.

For First Class, the Scout must grow in spirit and participa-

LEARNING TO SWIM IS EASY AT CAMP



Every Scout wants to learn to swim or to swim better. In camp, Red Cross instructors and older Scouts teach him how. Scout swimming combines skill, fun, and water safety.

SCOUTS LEARN BY WATCHING



An experienced leader shows these Scouts at close range how snakes look and behave. He trains them too in recognizing the different kinds.

tion. His scoutcraft test is to take an overnight hike sleep in the open or under a camp shelter and cook his meals outdoors. To prepare for this test of woodsman's skill he must assemble the right clothing and equipment. He must know health measures, first aid and be able to swim 50 yards. He must be able to find directions during both night and day, judge distances, sketch a map and send messages by Morse code. To show his growing knowledge of wild life he must identify ten trees or shrubs and four edible wild plants.

Trailing the Eagle with Merit Badges

After a Scout achieves First Class all of the merit badges are open to him. (A Second Class Scout may earn up to five of a selected list of merit badges.) Each merit badge has its own emblem and is worn on a merit badge sash.

There are more than 110 merit badges covering almost every activity that interests a Scout. Among them are sports, nature, handicraft and camping. By winning merit badges he learns about the world around him and may even decide what career he wants to follow. Merit badges teach him useful skills and interesting hobbies. Above all they

satisfy his desire to be doing things that are both worth while and enjoyable.

The ranks of Star, Life and Eagle can be earned by First Class Scouts. Star rank is awarded for five merit badges and Life for ten. Eagle, the highest rank in scouting, is given for 21 merit badges. For Life and Eagle a certain number must be the specific badges named in the official requirements.

Scouting a High Ideal

A boy begins to understand Scout spirit when he learns the Scout Oath and the Scout Law. Each of these is a clear statement of the ideals of scouting. Every Scout learns them by heart and understands their meaning. He tries to live up to them all his life.

The Scout motto is Be Prepared. With Scout training boys are ready to meet emergencies and to serve their community and country. When disaster strikes an area

Scouts act as messengers and helpers for relief workers. Scouts turn out when a child is lost, searching the countryside and making valuable use of their training. They help conserve natural resources by planting thousands of trees yearly.

During the second World War Scouts helped collect scrap metal, rubber and paper. They delivered notices and posters raised victory gardens and offered service when the government asked for it.

Outdoor Adventures

Scoutcraft teaches boys to become skilled woodsmen. A First Class Scout enjoys camping in the woods no matter what the weather. His shelter and bed are dry and he can make a tasty meal over an open



We're looking minutes at totem poles are favorite subjects with Scout woodcarvers.



Be Prepared means being ready to give speedy and helpful first aid to the injured. He's a Scout practicing applying splints to a broken arm and leg.

fire. He can cut down a dead tree and build camp "furniture."

He has a great time swimming with his buddies and wandering through the woods. His eyes are open to wild life and he knows many birds, trees, and plants. He knows how to stay healthy and avoid accidents. If an emergency arises, he is ready to act.

Many communities have provided permanent camps for Scout troops. In these camps nearly every hour of the day is filled with practise in scoutcraft, hikes, swimming, songs, and stories. No wonder Scouts look forward to camp all year long.

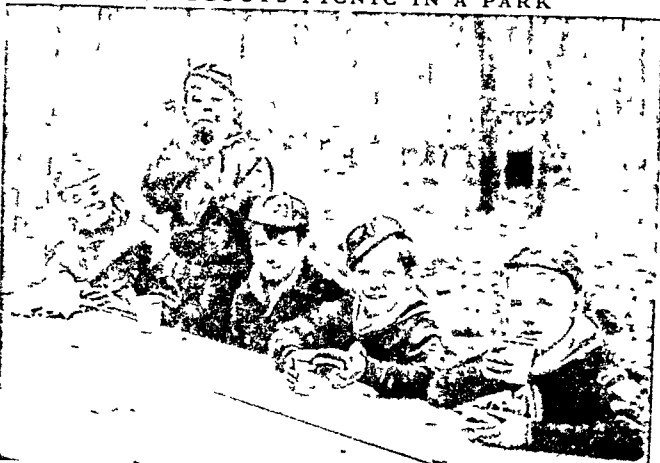
Cubbing—a Program of Fun and Achievement

The Cub Scouts offer younger boys a great variety of close-to-home activities. Cubs have their own organizations, uniforms, and meetings. They have advancement plans based on things that boys like to do in their play hours.

The Cub Scout *den* is like a patrol in a troop. The boy leader is called a *denner*. In charge of the den is the mother of one of the Cubs, called the *den mother*. Helping her is a Boy Scout, called the *den chief*. The den may also have a *den dad*. Several dens make up a *cub pack*, headed by a cubmaster and assistants.

Cub Scouts have three ranks—Wolf, Bear, and Lion. A boy of 8 starts with Wolf requirements and climbs to Bear and Lion. A boy who joins at 9 begins at once on Bear tests, and a boy who joins at 10 be-

CUB SCOUTS PICNIC IN A PARK



This den of Cub Scouts is having a fun-filled outing for a day. One of the high spots is plenty of hamburgers and milk for lunch—with music too.

gins with the Lion tests. At 10½, a Lion can achieve the special rank of Webelos (a name made up in part from the first letters of Wolf, Bear, Lion, and Scout). When a Cub has won this rank, he is ready to become a Boy Scout.

Each rank requires achievements in these activities (called by their Cub Scout names): feats of skill, the flag, keeping strong, helps, tools, collections, scrapbooks,

knots, safety, family fun, know your neighborhood, and reading. For Webelos, a Lion must pass Tenderfoot tests and carry out a service project for two months.

Cubs wear a blue uniform. They have their own insignia and badges. The Cub Promise is "I promise to do my best to do my duty to God and my country, to be square and to obey the Law of the Pack." Their motto is "Do your best."

Senior Scouting for Young Men

Scouts age 14 or older can continue with their troops or they can enter the Senior Scout program. This is also open to those who have never been Boy Scouts. Senior scouting offers three distinct fields of activities: sea, air and explorer. New members become Explorer Scouts. They may then select a Sea Scout ship or an

Air Scout squadron. Those that want to take part in all three fields join a Senior Scout outfit. All programs include social gatherings and community participation.

Sea Scouts combine the ideals of the Boy Scouts with seamanship. They become true sailors, learning

CUB SCOUT DOINGS



Every Cub Scout likes to make things with his hands. He gets a big thrill out of showing people what he can do with a hammer and other tools. The Cub Scout at left is putting a sandpaper finish on the toy locomotive he carefully put together with nails and glue. The Cub in the center is nailing up a new home for small birds. At the right, a den mother admires the birdhouse one of her Cubs has just made. Handicraft projects like these are part of the activities for every Cub Scout den.

SENIOR SCOUTS SEEK ADVENTURE IN WOODS AND ON WATER



At the left two Explorer Scouts are pitching a pup tent. When camp set up they'll be ready for days of forest ranging and exploration. At the right a Sea Scout signaller on the bridge of a ship sends a message accurately and rapidly with semaphore flags.

to handle boats ground tackle and rigging. They know sea history and the elements of navigation. Sea Scouts take real lake and salt-water cruises on boats and ships acting as the crew under their trained leaders.

The Sea Scout uniform is white in summer blue in winter like a real sailor's uniform. The ranks are Apprentice Ordinary Able and Quartermaster. Sea Scouts subscribe to a Sea Promise that requires constant vigilance in water safety and observance of the rules of the sea.

Explorer Scouts seek wider adventures to use their scoutcraft skills. They make expeditions on foot on horseback or by canoe. They climb mountains follow historic trails and paddle down backwoods streams.

Explorer Scouts make much of their own equipment. Their ranks are Apprentice Woodsman Frontsman and Ranger. The uniform is forest green.

Air-minded boys can participate in real aviation activities by joining the Air Scouts. Here they learn ground work and have a chance to do actual flying under competent instructors. They study construction and maintenance of real airplanes. They build models to learn aerodynamics and the theory of flight.

Weather communication and navigation are part of their intensive training for living and working in the Air Age.

How Scouting Began

Scouting ideals reach back to ancient times. The young men of Athens took an oath to be patriotic brave and reverent. The knights of the Middle Ages the Crusaders and the American frontiersmen had codes of honor that foreshadowed the Scout Oath and Law. Scouting as it is today aims to inspire boys and young men with great ideals—and to provide specific ways of living up to them.

The need for scouting arose in Africa during the Boer War. Robert S. S. Baden Powell (then a colonel in the British army and later Lord Baden Powell) had

GIVING SERVICE IN TIME OF NEED



Scouts are trained willing and ready to serve in any community emergency. Here they carry sandbags to help in building a levee for holding back rising flood waters.

the task of training recruits fresh from England. He saw that his men were unable to take care of themselves in the field or were often of weak and unstable character. To correct these faults, he worked out a series of "stunts in scouting."

On his return to England in 1903, he began to adapt his experiences to the training of boys. In 1907 he opened his first camp on Brownsea Island. His book 'Scouting for Boys' appeared the next year. Baden-Powell called himself one of several "uncles" of the Boy Scouts. He borrowed many of his ideas from older American groups—Daniel Carter Beard's "Sons of Daniel Boone" and Ernest Thompson Seton's "Tribe of Woodcraft Indians."

Later these two men were active in the Boy Scouts of America.

Scouting was brought to the United States by W. D. Boyce, a Chicago publisher. On a trip to London, Boyce was impressed by the courtesy of an English Scout and his refusal to accept pay for a "good turn." On Feb. 8, 1910, the Boy Scouts of America was incorporated in Washington, D.C. Congress granted a federal charter to the organization in 1916.

World Scouting

There are more than $4\frac{1}{2}$ million Scouts all over the world. Every four years Scouts from many nations gather for a *world jamboree*. The Scouts set up camp on the jamboree grounds and show each other

their native woodcraft skills. Through this world fellowship they work for better understanding and friendship for the lands they represent. The first world jamboree was held in England in 1920.

BRAMA. To the Hindus, Brahma is thought of as the creator of the world and the first member of the Hindu Trinity, which includes Vishnu the preserver, and Siva the destroyer and reproducer. In art he is represented with four heads and as many arms. In the Rig-Veda, one of the great religious books of the Hindus, dating from more than 1,000 years before Christ, the name Brahma represents the essence of the universe, from which all created things are evolved and into which they return. The primitive religion of the Hindus is called Brahmanism, from the name of its chief deity, and the term Brahman still denotes a member of the sacred priestly caste among the Hindus. (See Hinduism; India.)

BRAMHS, JOHANNES (1833-1897). The "three B's" is a phrase often applied to the composers Bach, Beethoven, and Brahms. The phrase was first used by the conductor and critic, Hans von Bülow, who was a friend of Johannes Brahms. In linking Brahms with two of the greatest composers who ever lived, Von Bülow expressed a judgment that is still accepted today. In Brahms's own day, many regarded him as a radical and an innovator. Actually, few composers were

closer than he to the classical tradition of Mozart and Beethoven. Brahms, however, took the classic forms and used them in new ways. He did not hesitate to use many themes at the same time and to employ unusual instrumental effects. For that reason his music often seems chaotic and muddy to young students even today. When the student learns to follow many themes and to listen to large combinations of sound, Brahms's music is as clear as any written by Mozart.

Brahms was born in Hamburg, Germany, on May 7, 1833. His father played the double bass in an orchestra and his mother kept a small shop. At the age of eight the boy began his lessons in piano playing.

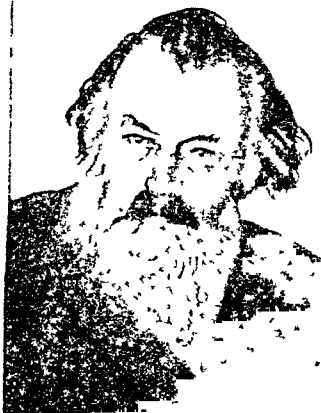
Soon, because of his great talent, he was receiving these without charge. He began to compose at 11 and at 15 gave his first concert. At the age of 20 he toured as accompanist to the violinist Reményi. At one of these concerts he found that the piano was tuned a semitone too low and so transposed a Beethoven sonata at sight, a prodigious feat. The violinist Joachim, who was present, was so strongly impressed that he gave Brahms a letter to Robert Schumann. After hearing him play, Schumann published an enthusiastic account that drew the attention of all German musicians to the young composer.

Brahms retired into comparative obscurity, however, taking a

position at the court of the Prince of Lippe-Deimold that gave him time for composing. Madame Schumann played his compositions at her recitals and thereby added to his growing fame. In 1862 he settled in Vienna, where he spent most of the rest of his life. He later accepted the directorships of two Viennese musical societies. At the death of his mother in 1865 he composed his famous 'Requiem'. After 1875 he gave up all public positions to devote himself to composition. Upon receiving a doctoral degree from Breslau University in 1879 he wrote the light-hearted 'Academic-Festival Overture', based upon students' songs.

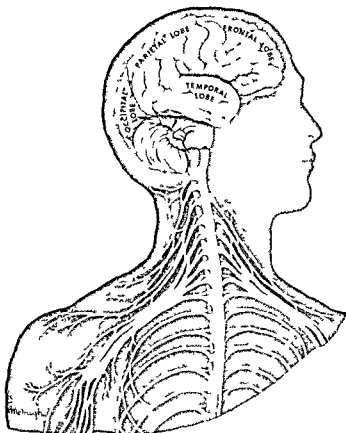
Brahms cared little for outward show, refusing to go to Cambridge University, which offered him a degree, largely because he did not want to submit himself to the formality he imagined English life required. He lived chiefly within himself, and yet his knowledge of the world around him was wide. He was a sturdy large-framed man, of placid bearing and serene temper, quite unmindful of popular approval. His humor was at times rather grim and frequently sarcastic. He was, nevertheless, a kindly man and a warm friend to those he liked. Occasionally he took short trips to the Austrian Tyrol or to Italy. He never married. He died in Vienna April 3, 1897, and was buried near the graves of Beethoven and Schubert.

JOHANNES BRAHMS



One of the world's great composers, he brought new life to old forms.

The WONDERS of MAN'S BRAIN



The brain is a complicated knot of nerve fibers. Its complex interconnections make possible man's rich mental life and wide abilities. The brain is in constant communication with the body parts through the spinal cord and its many branching extensions—the nerves themselves.

BRAIN AND SPINAL CORD A particularly clever or intelligent person is often spoken of as "brainless." This expression shows that a person's ability to reason, remember, or think ahead is thought to lie in his brain. This is true, but the brain is responsible for many important functions besides these higher processes as they are called.

To understand the brain we must first know a few facts about nerves. If we think of the nerves which run throughout the body as railroad lines, then we can consider the centrally located brain as a fantastically complicated switchyard. Here all the nerves connect with one another in a complex but orderly manner (see Nerves).

The Nerves and Spinal Cord

The only thing nerves can do is carry messages or impulses from one part of the body to another. The meaning of the message depends on which nerve fiber carries it. Thus certain nerves—the *sensory nerves*—carry messages from our various sense organs to

the brain. Other nerves carry impulses from the brain to the muscles and cause them to contract. Nerves with this kind of job are called *motor nerves*. Still other nerves control our internal organs, making the heart beat faster or slower or letting us know when we have a stomach ache. They are called *autonomic nerves*.

All these nerves join in a sort of cable which routes the impulses to or from the brain. This cable runs up the middle of the back and is called the *spinal cord*. The spinal cord is well protected. It runs through a long tunnel of bone called the *vertebral column* or backbone.

Although the main job of the spinal cord is to carry nerve messages to and from the brain, the cord is also capable of handling certain impulses by itself without involving the brain. The acts which the cord can control by itself are the *spinal reflexes*. They are very simple and automatic in nature. They include such activity as routine regulation of the internal organs in digestion and some simple bodily movements such as the knee jerk.

The spinal cord has pathways that specifically carry in-

coming messages from sense organs. These are the *sensory* or *ascending tracts*. Other pathways are responsible for outgoing messages from the brain to muscles and glands. These are the *motor* or *descending tracts*. Their nerve impulses go out over the motor nerves and bring about various actions in the body.

Above the neck region the nerve fibers of the spinal cord fan out and form a number of interconnected enlargements or *centers* that control certain types of body activity. All these various centers are located inside the top of the skull or *cranium* and, considered together, make up the *brain*.

Structures of the Brain

Located at the very top of the spinal cord is the lowest part of the brain—the *medulla oblongata*. The medulla appears simply as a thickening of the cord. This important center, however, controls our breathing, heartbeat, and blood pressure. It is this part of the brain that is damaged in the most severe form of poliomyelitis called *bulbar poliomyelitis*.

Directly above and behind the medulla lies the *cerebellum*. Many of the nerve fibers important in helping us move our bodies pass in and out of this part of the brain. The cerebellum does not start any of our movements. Its function is to keep the muscles in *tone* (elastic and ready to move) and to co-ordinate different muscles so that movements are smooth and precise. Another part of the cerebellum, connected with the organs of balance deep within the ear, helps us to keep our equilibrium.

Immediately in front of the cerebellum and connected to it by many nerve fibers is the *pons*. What the pons does is not well understood, but it is connected to an important nerve serving the face and mouth.

The next important part of the brain as we travel upward is the *thalamus*. This organ receives incoming sensory nerve fibers and sorts them according to the kind of message they carry. There are centers in the thalamus whose nerve fibers come from the eye, others from the ear, and so forth. Once the nerve tracts are sorted according to function, the thalamus directs them to the correct part of the main brain above.

The *hypothalamus* is a relatively small brain center but one with a great number of important jobs. It makes the internal organs and the blood system work together. The medulla has a similar function, but the hypothalamus has a much more complicated role since it takes into account the activity elsewhere in the brain—particularly in the higher centers. It co-ordinates these activities in a pattern of action that includes the internal organs, the blood vessels, and so forth. The hypothalamus is particularly active when our emotions are roused. For example, when the hypothalamus receives an impulse from higher centers indicating something to be frightened of, it prepares the whole body to run or fight, depending on the circumstances. It sees to it that the muscles get the blood they need for the emergency, that the breathing tubes are expanded so as to bring enough

its function as chief director of autonomic activities in the body, this little organ also helps determine when we feel hungry or thirsty or sleepy.

The hypothalamus has the help of another organ that is attached to it—the *pituitary gland*, or *hypophysis*. The secretions of this gland affect other glands in the body by controlling the output of their secretions. For this reason, the pituitary is often called the “master gland.”

The Cerebrum

Above the hypothalamus lies the largest and most complicated part of the brain, the *cerebrum*, which comprises about one half the weight of the entire nervous system. The cerebrum has a core of “white matter,” which is simply the great bundles of nerve fibers that are ascending from or descending to the lower centers of the brain and the spinal cord. The *corpus callosum* and *fornix* form the central portion of this white core. Completely covering the core on all sides is a layer of “gray matter” called the *cortex* (meaning “shell” or “rind”). Nerve fibers are white because most fibers are covered by a white, fatty sheath (*myelin*). The cortex is gray because it is composed of nerve cell nuclei that are never covered by myelin (see Nerves). The fact that the cortex is gray is the basis for the popular but false notion that the amount of “gray matter” is a measure of intelligence.

In man the cortex is folded upon itself and has a wrinkled appearance—much like the kernel of a walnut. The ridges in this wrinkled cortex are called *convolutions*, or *gyri*, and the furrows between the ridges are designated *fissures*, or *sulci*. The deepest of these fissures is the *longitudinal fissure*, which runs along the mid-line of the cerebrum from the back of the head to the front. This divides it into halves called the left and right *cerebral hemispheres*. Other main fissures on the cortex divide each hemisphere into four separate parts, or *lobes*—*frontal lobe*, *parietal lobe*, *temporal lobe*, and *occipital lobe*. The position of these is shown on the preceding page.

Like the spinal cord, the brain is well protected by a bony covering, the *skull*. Both brain and spinal cord are also protected within the bone by three separate layers of membrane called *meninges*. These three meninges are named the *dura mater*, *arachnoid membrane*, and *pia mater*. An infection of the meninges is called *meningitis*. The middle membrane—the arachnoid—is actually not a continuous sheet but is weblike, with many open spaces. Through these spaces flows the *cerebrospinal fluid*. (This fluid also circulates through the interconnected open spaces within the brain called *ventricles*.) The nervous system is thus surrounded and cushioned by the cerebrospinal fluid. These outer structures enable the brain and spinal cord to withstand knocks and blows that would otherwise damage them. The meninges are sensitive to pain and are responsible for our headaches. The brain itself is insensitive to pain.

Our Senses and the Cortex

Parts of the cortex are the connection points for the nerve impulses originating in the sense organs.

THE SIZE OF THE BRAIN

Average weight.—In an adult human male the brain weighs about 1,350 grams (3 pounds); the female brain weighs a little less. One of the largest normal human brains (2,231 grams) belonged to Oliver Cromwell; but brain weight alone is not a measure of intelligence.

The brain of a chimpanzee weighs about 370 grams (13 ounces); the elephant's brain, about 4,500 grams (10 pounds); the whale's, 9,000 grams (20 pounds).

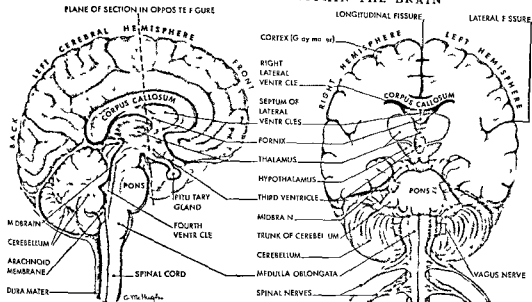
Proportion to body weight.—At birth the human brain forms about $\frac{1}{4}$ of body weight. Its weight increases rapidly and attains a maximum by the 20th year; it then represents about $\frac{1}{50}$ of the body weight.

In the canary the brain is about $\frac{1}{12}$ of the body weight; in the whale it is about $\frac{1}{20,000}$.

air into the lungs, and that the iris of the eye is open wide for optimum vision. These are typical reactions to fear. The hypothalamus, of course, makes different bodily adjustments for different emotions. Aside from

PRINCIPAL STRUCTURES WITHIN THE BRAIN

PLANE OF SECTION IN OPPOSITE FIGURE



LEFT HALF OF BRAIN AND CORD

The hemispheres of the cerebrum or upper brain have an outer layer of gray matter. This layer the cortex is believed to be the seat of the higher "thinking" functions of the brain. In the center of the brain are four hollow ventricles filled with fluid. The third ventricle is surrounded by the thalamus and hypo-

SECTION THROUGH BRAIN VIEWED FROM THE FRONT

thalamus (shown in red on both drawings) which together make up the interbrain. The nerve trunks of the midbrain connect the cerebrum with the lower centers and the spinal cord. The pons and cerebellum form the hindbrain, and below these structures lies the medulla oblongata at the top of the spinal cord.

The senses of vision, hearing, taste, smell and touch have each an area on the cortex where their nerve messages are collected. Some think that consciousness results when nerve messages from sense organs reach this highest level of the brain.

Visual experiences are collected at the very back of the cortex, in the *occipital lobe*. Within this *visual area* the incoming messages from the eye are distributed according to the various directions in which we can see. For example, if you stare straight ahead you will be able, of course, to see some things to your left, some to your right, some above, and some below. This total area is called the *visual field*. What you see to your left is directed to the right side of your visual area, what you see above is directed to the lower part and so forth. In this way although the impulses are turned about somewhat the cortex registers a spatial image of what you are seeing. People who have the visual area of their cortex damaged are for all practical purposes blind.

The part of our cortex concerned with what we hear is arranged somewhat differently. This *auditory area* is located in the temporal lobe. When we hear sounds, the impulses reaching this area are divided according to the pitch of the sound. Thus a certain part of the hearing center is active when we hear high sounds and another part when we hear medium pitched sounds. Low sounds bring about nerve activity in still another section. When one hears sounds of many pitches at the same time the entire hearing center is active.

The *body sensory area* which is concerned with touch is organized so that each different part of our skin sends its messages to a different section of the cortex. A part of this brain center is connected to the skin of the hand, another to the face, and so forth. Just which part of this area is signaled allows us to know which part of our body is being touched. Furthermore, the more sensitive the particular part of the skin, the larger is its share in this sensory area. In the case of touch, the cortex also does its job in a crossed way. This is to say that the right cerebral hemisphere takes care of the left half of the body and vice versa. The dominance of one hemisphere or the other (unilateral brain dominance) is thought to give rise to right- and left-handedness. Shifting the natural handedness is regarded by some as a cause of certain types of reading difficulty.

Impulses concerning taste are also collected in the body sensory area. The taste centers lie at the lower end of this area. Impulses concerning the sense of smell are collected in a special area lying within the temporal lobe. No one knows exactly how sensations of taste and smell are presented to the brain.

The Cortex and Control of Our Movements

One part of the cortex brings about bodily movements by sending nerve messages (motor impulses) to the various muscles of the body. This area is located toward the front of the cortex. This *motor center*, like the touch center, is divided according to the various parts of the body it activates. A movement of

the hand originates in one place, while the foot or face or shoulder is moved from another part of the center. The greater the number of movements that a particular part of our body is capable of making, the larger is its share in this movement center. The hand, for example, which is capable of so many different and precise movements, has as much cortex controlling it as the entire trunk and legs.

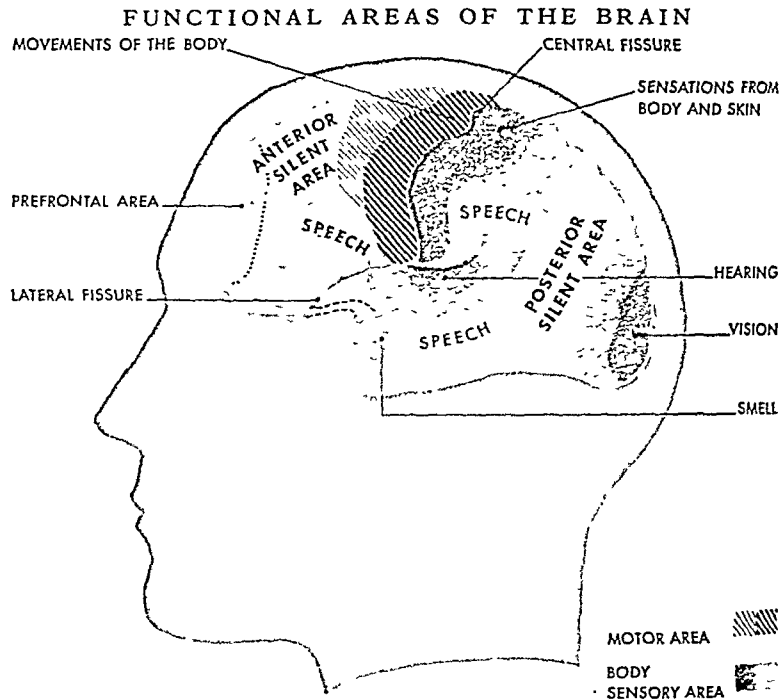
Damage to the motor center of the brain causes paralysis. This is what happens to a person with high blood pressure when he has what is commonly called a *stroke*, or *apoplexy*. Such damage can be caused by hemorrhage or a brain tumor. Paralysis results to various parts of the body and in varying degree according to the location and extent of damage. Damage to the right side of the brain causes left-side paralysis, and vice versa. This of course is due to the fact that the motor centers controlling one side of the body lie in the opposite side of the brain.

Mental Activity

Everyone believes that "mental" activity is handled by the brain. It is not altogether clear, however, just where and how the brain manages it. Most of what is known about the relationship of the brain to mental activity has resulted from studies of brain damage either accidental or surgical.

The so-called "silent areas" of the cortex—where neither incoming messages are received nor outgoing nerve impulses start—are generally thought to be the places where the brain does its complicated mental work. These centers make up quite a large part of the cortex, as can be seen in one of the drawings. Although some authorities have suggested that these silent areas can be broken up into various smaller parts responsible for separate kinds of mental activity, this is not yet certain. There are two important silent areas—one in the forward part of the frontal lobe and another in the parietal and temporal lobes.

The drawings show that the posterior silent area is practically surrounded by those parts of the cortex which receive impulses from the sense organs. There is reason to think that all this sensory information is put together here to form the rich picture of one's surroundings which man is capable of appreciating and remembering. When we see dinner on the stove and smell its delicious odors and hear the sounds of it cooking, these impressions are all combined into one picture in our "mind." More than this, such im-



Mapped here on the left hemisphere of the brain are the motor center, the sensory centers, and the silent areas. A map of the

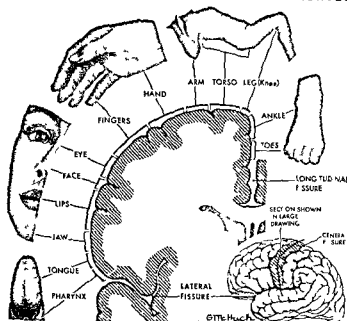
right hemisphere would be a mirror image of this except for the speech areas, which have been identified only in the left hemisphere.

pressions are mixed with our memories of past meals and our anticipation of how the food will taste when we eat it. There is also good reason to believe that man's ability to recognize very small, subtle differences in what he senses is managed here. For example, when this part of the brain is damaged, two lights have to differ considerably in brightness before one is recognized as brighter than the other.

Since this part of our brain seems to be a sort of "clearinghouse" where incoming information from our various senses is organized to make a sensible whole experience, many think that this silent area is also at work when we read or listen to someone speak. Apparently our understanding of language is partly carried out in this part of the cortex. One's ability to speak or write, which, of course, involves bodily movement, seems to be controlled by centers closer to the front of the cortex near the motor center.

The silent area in the frontal lobe is generally thought to be where man carries out his more complex "thinking" and "planning." This may or may not be true, but there is reason to believe that this part of the cortex is in some way concerned with the more complicated mental activities. This *prefrontal area*, for example, plays a role in fixing and maintaining attention. When it is damaged by accident or surgery, some people seem to have trouble concentrating intently on one thing at a time. Monkeys with their prefrontal areas removed have considerable trouble in solving problems that require them to do a series of things in a certain order. It seems clear, then, that

THE MOTOR AREA AND THE PARTS IT CONTROLS



The motor area of the left side of the cortex is diagramed here in cross section. Parts of the body are shown in a size propor-

tionate to the area of the brain controlling them. The main sensory area has a similar pattern of distribution for the body

and remember simple things even though their brains have no cortex at all. It is clear therefore that a cortex is not necessary for such mental activity. It may be that man's large cerebrum is the part of his brain that allows him to learn more things at one time to learn them more quickly and to remember them longer. It may not be the organ with which man actually learns or in which memories are stored for later use. A great deal more scientific study is required to settle this problem.

The Brain in Intelligence and Insanity

Everyone agrees that a person's general intelligence depends on what kind of brain he has. Scientists, however, have not yet been able to see consistent differences between the brains of the more and the less intelligent. Extremely intelligent people do not necessarily have very large brains. It may be that certain chemical and electrical reactions that take place in the brain when it is active determine how efficiently the brain operates.

This part of the cortex does play a role in the ability to think and plan. It also is certain that this is not the only part of the brain involved. For one thing when certain types of mentally sick people have this part of their brain separated from the rest of the brain by surgery (a *prefrontal lobotomy*) they can still solve problems about as well as before. In some of them, in fact, scientists can find no difference in problem solving after the operation though there may be personality changes.

The Brains of Lower Animals

The major changes appearing in the brain as one moves from the simpler to the more complicated animals and finally to man, are changes in the relative size and importance of the various parts of the brain. In amphibians and reptiles the cortex is quite small and is concerned only with the sense of smell. Further along in animal development—in the birds to be exact—the cortex includes other senses. From the birds on up to more and more complicated animals the cortex becomes larger and has more and more different jobs to do. As the cortex as a whole grows larger and more important in the higher animals, the frontal lobe becomes larger in proportion.

In view of this development through the animal series it has been assumed that the cortex and particularly the frontal lobes so greatly developed in man, were the parts of the brain that gave man the greater mental ability which differentiated him from the lower animals. As reasonable as this seems it is still an unproved theory. Fish and even cockroaches can learn

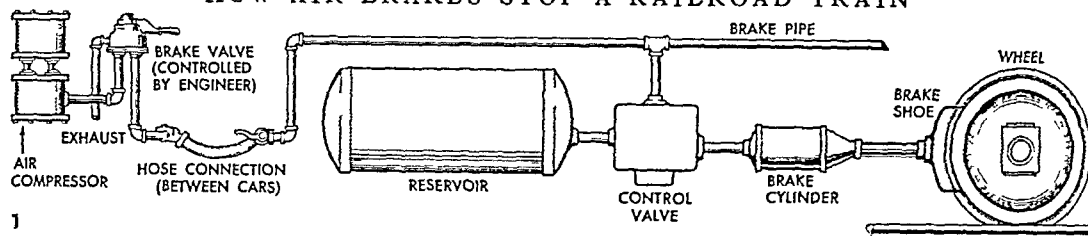
and remember simple things could have a great deal to do with determining how intelligent a brain is but this has not yet been proved. Moreover scientists have so far found no special foods or drugs capable of improving the 'intelligence' of a brain.

Much the same uncertainty appears when we turn to the problem of what the brain has to do with the various forms of abnormal behavior. Many cases of *amnesia* (loss of memory) and *aphasia* (inability to use or understand language) are associated with definite brain damage. In *epilepsy* and in a few of the more severe forms of mental illness, it is also the functioning of the brain that is at fault.

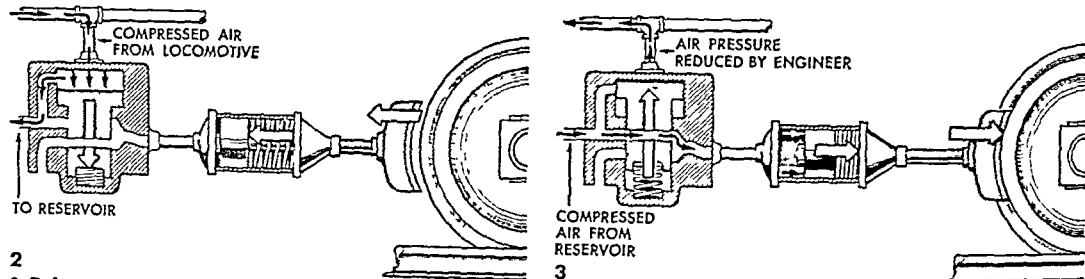
Study of brain waves indicates that this is the case. Brain waves are minute electrical currents generated within the brain. They can be recorded in the living brain by an *electroencephalograph*. A record (*electroencephalogram*) of the brain of an epileptic person is almost always found to be abnormal.

Except for a few special cases the brains of people who have either severe forms of mental illness (*psychoses*) or milder forms (*neuroses*) do not appear to be different from normal brains. In the neuroses it seems likely that the basic problem is not in the brain itself, but in certain habits that the person has developed. In certain cases psychoses have been associated with malfunctioning of the brain, but for most types it has not yet been proved that the brain itself is at fault. It may be that scientists have not yet looked for the right things in comparing the brains of normal and insane persons.

HOW AIR BRAKES STOP A RAILROAD TRAIN



1 The Westinghouse air brake works with high-pressure air from a compressor on the locomotive. Coupling hoses join pipes under the cars to make a continuous air line the length of the train. The engineer governs the pressure of the air in this line with the brake valve in his cab. Control valves on the cars respond to changing pressure in the air line to set or release the brakes.



2 Before a train starts, the compressor builds up pressure in the air line. In the control valve under each car, the pressure forces down a sliding piston, opening a passage that admits compressed air to the reservoir. There the air is stored until needed. 3 To apply the brake, the engineer releases some air from the air line, reducing pressure. A spring shifts the control valve, and compressed air from the reservoir forces the brake shoe against the wheel. To release the brake, the engineer restores full pressure in the line. This renewed pressure pushes the piston in the control valve back to the position shown in (2). Compressed air in the cylinder escapes through the lower channel of the control valve, and a spring releases the brake.

BRAKES. When a boy wants to stop his scooter or coaster wagon, he puts out one foot and lets it scuff along the ground. In other words, he uses his foot as a brake. This action illustrates a fundamental point about most kinds of brakes. They stop a moving vehicle by using friction in some way.

Friction is usually applied to the wheel of the vehicle. The simplest way of doing this is probably that used by an old-fashioned wagon brake. Here a curved *brake shoe* is pressed against the outer surface of the wheel itself. A wagon brake has a simple pivoted arm which the driver uses to press the shoe against the wheel. Older types of railroad brakes also use a shoe which is pressed against the wheel. In the familiar automobile brake, a *brake drum* is bolted solidly to the wheel; the shoes are mounted inside this and press outward on the drum. Most airplane brakes are similar. Some automobiles, airplanes, and railway cars have *disk* brakes. Here a disk is bolted to the axle or to the inside of the wheel. Another disk pressed against it stops the vehicle. Another way of applying friction employs a *brake band*. This is a length of flexible material looped around the outside of a brake drum.

Tightening the loop holds the drum motionless. The parking brake on some automobiles is a band brake.

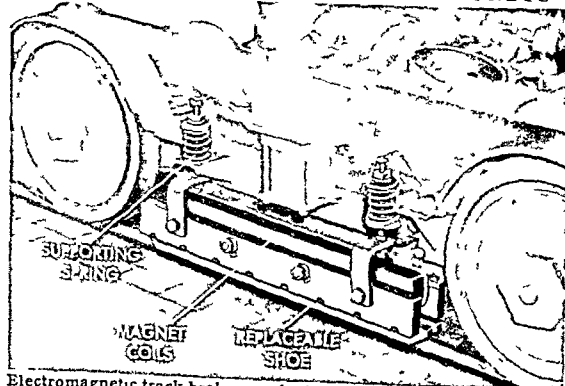
Types of Brake Systems

Brakes are generally classed as *mechanical*, *hydraulic*, *compressed air*, or *electromagnetic*. A mechanical brake is simply a linkage for increasing the pressure that a person can exert on the brake shoe or band. Mechanical brake systems serve as parking, or *holding*, brakes in automobiles, railway freight cars, and streetcars.

Hydraulic brakes are described in the article on Automobile. Such brakes are used also on all but the smallest airplanes.

The best-known compressed-air brake is the Westinghouse air brake. A greatly simplified diagram of

STOPPING A STREETCAR WITH MAGNETS



Electromagnetic track brakes are built into the trucks of many modern streetcars. When the motorman switches electricity through its coils, the brake seizes the track and helps stop the car.

this brake appears on this page. The actual brake has two reservoirs, for emergency and regular operation. Westinghouse brakes are used on all railroad cars, both passenger and freight. These brakes set whenever pressure in the air line drops. Therefore, if a car breaks loose from a train, its own brake quickly brings it to a stop because the air line is cut. This safety feature led practically all American railroads to adopt the Westinghouse

brake shortly after it was introduced by George Westinghouse in 1868.

Westinghouse air brakes are also used on streetcars and on many trucks and busses. On streetcars, pressure is usually applied to disks on the axles, rather than to the wheels, this is also true of most modern railway installations. In trucks and busses, the Westinghouse equipment generally operates regular automotive drum brakes.

Two different braking systems use electromagnetic force. One, the streetcar track brake pictured on the opposite page, is simply a modified friction brake. Electromagnets cause a long brake shoe to slide

along the track and aid in stopping the car. Entirely different is the *dynamic brake* used in electric locomotives and modern streetcars. These vehicles are run by electric motors. For dynamic braking, the motors are wired so that they can work as generators. Made to function in that way while the car is in motion, the motors exert a powerful drag which tends to stop the car. Since this braking force decreases as the car slows down, other brakes have to be used in connection with dynamic brakes.

The so-called *air brakes* used on some military planes are simply flaps of special design. They are used to check the speed of the plane in diving.

USEFUL and Ornamental BRASS

BRASS The most common alloy of copper is brass. This long-wearing and handsome metal has a great many important uses in manufacturing building and decoration. It is easily worked and resists corrosion. Moreover, the composition of brass can be varied to get any of several different degrees of hardness, ductility, or tensile strength.

Essentially brass is an alloy of copper and zinc (See Copper, Zinc). Its related copper alloy, bronze, is made of copper and tin. The amount of zinc in various kinds of brass ranges from 5 to 45 per cent. Small amounts of other metals, usually not more than 3 per cent, may be added for special purposes.

The various kinds of brass, the percentage of copper and zinc each contain, and their characteristic colors, are listed in the following table.

| NAME | COMPOSITION | | COLOR |
|-----------------------------|-------------|------|---------------------|
| | Copper | Zinc | |
| Muntz metal | 59% | 41% | Reddish |
| Extruded rivet metal | 63% | 37% | Typical brass color |
| High brass | 66% | 34% | " |
| Cartridge or spinning brass | 70% | 30% | " |
| Brazing brass | 75% | 25% | Red gold |
| Low brass | 80% | 20% | |
| Rich low brass | 83% | 17% | |
| Red brass | 85% | 15% | Red |
| Composital | 90% | 10% | Bronze |
| Gilding metal | 95% | 5% | Copper |

These brasses have a wide range of uses. Muntz metal is used in architectural work, welding rods, condenser tubes and valve stems. Extruded rivet metal is made into rivets and screws. High brass is formed into radiator cores, springs, grill work, and chains. Cartridge brass is used for cartridges, shell casings, tubes, and eyelets. Brazing brass is particularly suited for soldering. Flexible hose is made from low brass. Rich low brass is used to make Fourdinner wire, a fine wire which can be woven into a mesh. Red brass is used for hardware, plumbing pipe, condenser tubes and flexible hose. Commercial brass is widely found in screen wire, forgings, and costume jewelry. Gilding metal is used as a decorative surface coating.

Sometimes brass is named for the small amount of extra metal it contains. *Aluminum brass* has about 3 per cent of aluminum. This raises the tensile strength but lowers the ductility, that is, the property of being hammered thin or drawn out. About 2 per cent of tin added to brass makes *tin brass*. This alloy is often used for naval construction because it resists corrosion in sea water. It is sometimes called *naval brass*. *Manganese brass* is hard and resists corrosion. Its extra elements are about one per cent each of tin, iron and manganese, and sometimes a little aluminum.

Iron brass is also known as *delta metal*. It contains 1 to 3 per cent of iron and a little manganese and tin. Its tensile strength is far greater than brass made with only manganese and tin. In brass to be used for filing or turning, about 2 per cent of lead is added. This *lead brass* is softer and is less liable to foul the filing tools or clog automatic turning machines.

All these brasses are called *modified brasses* because of their extra elements. Sometimes arsenic, antimony and bismuth are found in brass as impurities, but their presence is accidental. These metals tend to

ARTISTIC BRASS FROM JAPAN



This craftsman of Kyoto is doing damascene work, which consists of cutting a narrow grooved outline in the brass metal and hammering in strands of gold and silver wire.

make brass extremely brittle.

Steps in Making Brass

As with most alloys, the metal with the higher melting point, copper, is melted first. The fuel is usually granular charcoal. The zinc is warmed separately, then added to the melt in small pieces. It is added just before the molten metal is cast. If added earlier, the zinc would burn away into vapor. In any case, about 5 to 10 per cent of the zinc is lost through vaporization and oxidation, because the melting point of copper is higher than the boiling point of zinc. When scrap brass is reclaimed by melting, some of the zinc is also lost and the quality of the brass changes.

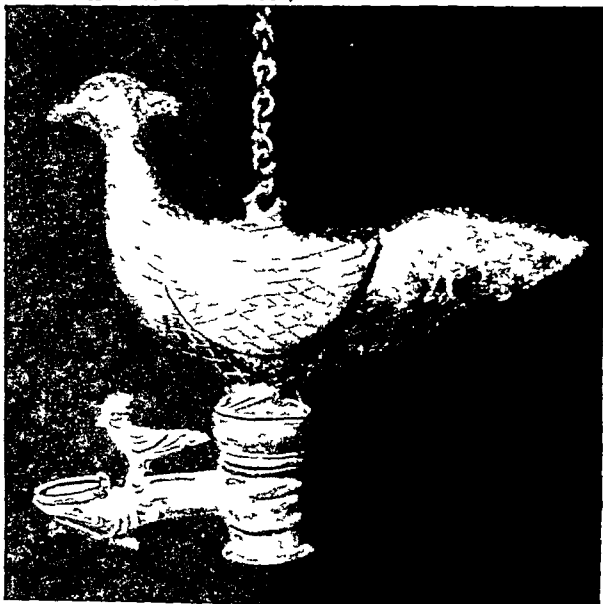
Alloys high in copper can be worked either hot or cold. Brass with less than about 60 per cent of copper is seldom worked cold because it gets brittle and requires too much annealing.

Machine bearings, gas or water taps, and various other brass products are sometimes made by casting molten brass into sand molds. But modern practise favors automatic machines which draw, press, stamp, or spin the metal into the finished articles. Stamping resembles pressing except that the operation is performed in one blow. Pressing produces the finished article by a steady pressing of brass through or into a die.

Pins, chains, and many small products are stamped out entirely by machines. For intricate devices or ornaments, various parts are stamped or pressed out separately and then brazed or soldered together. Gas and electric fixtures are among many such assembled products.

A thin brass coating can be applied to such objects as

A BRASS LAMP, MADE IN INDIA



This hanging lamp was cast in a clay mold; then the pheasant top was decorated. Vegetable oil flows down to feed a wick in the cup-shaped projection at the bottom.

iron and steel hardware and fixtures by electroplating methods. The solution used is an alkaline cyanide bath, and simultaneous deposits of copper and zinc are laid down. Sometimes an intermediate coating of brass is placed under an outer coating of nickel, chromium, or silver. Brass coatings are often used over iron and steel to help an outer coating of rubber to adhere to the metal.

Brass is spun in the same fashion as a potter shapes clay on his wheel. The workman sets a thin sheet of brass spinning rapidly in a lathe, then uses a burnishing tool to

press and form it around a die or chuck of the desired shape. Under the hand of a skilled worker, the sheet will cup in or flare out almost as though the brass were plastic clay. Thin-sided flower vases are often made in this way.

Brass can be made in many colors, by adding other metals to the alloy, by variations in the heat applied, or by the action of certain chemicals. Finished articles are often coated with a clear lacquer to prevent tarnishing.

The earliest brass objects probably owed their existence to the accidental presence of zinc in the copper ores. But when men learned the difference be-

tween zinc and tin the production of brass rapidly surpassed that of bronze. In the Middle Ages a flourishing industry in brass grew up in Europe. It centered in the Meuse Valley of Belgium, where zinc was found. The industry later spread to Germany, northern France, and England. Magnificent ornamental brasses were cast for cathedrals—fonts, lecterns, chandeliers, candle-

BRASSWORKERS OF THE HOLY LAND



Old shell cases blossom into things of beauty under the clever fingers of these Yemeneite Jews. Their traditional seven-branched brass candelabra leave workers of the Near East, like those of India, gain their renown through the patiently worked out detail of carving and inlaid patterns.

sticks and locks. For brass monuments sheets of brass were used. Figures of the people, coats of arms or inscriptions were engraved on these sheets and the deeply incised lines were filled with enamel or inlaid with silver. Sheet brass decorations for early English churches were called *batterings*.

Until the middle of the 18th century brass was hammered into sheets by a process called *battering* and the foundry was known as a *battery*. In modern industry, however, the rolling mill has replaced the battery.

From earliest times in America there were many establishments that made brass wares such as buttons, clocks and tinware. They were sold by traveling ped-

dlers. The colonists used brass cannon in the Revolutionary War and early naval vessels were equipped with cannon of the same alloy. Paul Revere was widely known for his skill in brassworking. One of the earliest rolling mills in the United States was built at Torrington, Conn., in 1834.

Today much of the American brass industry is located in the towns between Torrington and Derby, Conn., along the Naugatuck River. Copper in the form of ingots and zinc (called *spelter* in the industry) in the form of plates are sent here from national sources (see chapter 2 on). Demand for brass cannon and rifle shells greatly increased production during World War II.

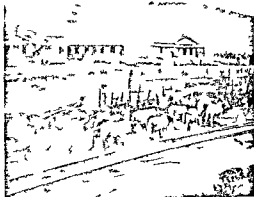
Giant BRAZIL, with WEALTH for TODAY and TOMORROW

BRASIL. One of the giant countries of the earth, the United States of Brazil is exceeded in size only by Greater China, Russia, and Canada. It spreads over almost half of the South American continent, crossing both the equator and the Tropic of Capricorn. Its fertile, well-watered land yields an abundance of tropical and subtropical crops, including most of the world's coffee. In colonial times its gold and diamonds enriched its mother country, Portugal. Today huge deposits of iron and manganese await the demands of the industrial age.

Brazil has been called the *land of the future*, for it contains vast empty spaces still open for settlement and unexploited ore reserves. Its thinly populated areas are likened to the North American *wild West* of a century ago. Problems too great for the individual pioneer, however, bar the settlement of some areas. Their conquest awaits the organization and financing of large-scale drainage, power, irrigation, public health, transportation and community projects.

The roughly triangular outline of Brazil resembles that of the *South American continent*. Its land boundaries touch every country in the continent except Ecuador and Chile. On the east the Atlantic Ocean laps a coast line of more than 4,500 miles.

More than half of Brazil's 3,286,170 square miles consist of low plateau or tableland between 600 and 3,000 feet in elevation. The broad Brazil High-



This sugar plantation is connected with the mill by a narrow-gauge railway. Cane has been hauled from the field in a bullock cart. Notice the stucco houses of the plantation workers.



Thousands of coffee trees fill the hillsides of this São Paulo fazenda. Workers are picking the berries. The coffee, after curing, is shipped throughout the world as Brazil's leading export.

Extent.—Greatest extent from north to south and from east to west about 2,700 miles. Area, about 3,286,000 square miles, about half of South America. Population, 1950 census, 34,000,000. Density, 52 per sq. mi.

Natural Features.—Low Amazon plain in the north and west, coastal plain facing the Atlantic, elevated plateau in the central and south. Chief rivers: Amazon with main tributaries Negro, Madeira, Tapajós, São Francisco, Tocantins, Paraná, Paraguay, Uruguay.

Chief Cities.—Rio de Janeiro (capital, 2,335,931), São Paulo (2,041,716), Recife (Pernambuco, 522,466), Salvador (Bahia, 400,000), Porto Alegre (Rio Grande do Sul, 300,000), Belo Horizonte (Minas Gerais, 200,000), Curitiba (Paraná, 100,000), Santos (over 200,000), Natal (Rio Grande do Norte, 100,000), João Pessoa (over 90,000).

Products.—Coffee, rice, sugar, cacao, cotton, corn, beans, cassava, oranges and other fruits, cattle and huge, rubber, lumber, Bauxite, carnauba wax, a tincture, babassu and other oils, carnauba, gold, diamonds, semiprecious gems, iron, manganese, iron ores, quartz, crystal, chrome, mica, zirconium, cotton and other textiles, iron and steel, paper, cement, hides, skins and leather goods, chilled and dried beef.

VARIED EXPANSE OF SOUTH AMERICA'S LARGEST COUNTRY



Brazil is the only nation in the world that extends from the equator into the middle latitudes. North and west lie the low-

lands spread across the entire heart of the country. They are traversed by mountain ranges of moderate altitude. The easternmost is the spectacular Serra do Mar, or Great Escarpment, rising abruptly from the coastal plain. From this range towers Brazil's highest peak, the Pico da Bandeira, 9,462 feet high. Inland the Serra do Espinhaço (Backbone Range) parallels the coast from Minas Gerais north to northern Bahia, and contains Brazil's chief mineral deposits. A smaller plateau is the Guiana Highlands, which slope down from the northern frontier.

The basin drained by the mighty Amazon River in the north contains most of Brazil's 40 per cent of lowland. Seldom rising more than 500 feet above sea

lands of the Amazon basin. East and south stretch plateaus seamed with low mountains. The principal cities are on or near the coast.

level, its rain forest, swamps, and savannas stretch from the foothills of the Andes on the west to the Atlantic Ocean. Other plains lie in the swampy basin of the Paraguay River in the southwest, and intermittent coastal plains border much of the seaboard.

Brazil's Great Rivers

As the map reveals, Brazil has an extensive river system. The Amazon is, of course, the largest, since it has the greatest volume of any river in the world (see Amazon River). Many of its tributaries are giant streams too. Most important are the Negro, the Madeira, and the Tapajós. In the south, the Paraguay, Paraná, and Uruguay flow out of the country to form the La Plata. The Tocantins and the São Francisco

BRAZILIANS SHOPPING AT A STREET MARKET IN SÃO PAULO



The faces of these Paulistas reflect the variety of races and nationalities in the population. A Japanese couple is operating the vegetable stand, while Negroes and whites of various

national backgrounds mingle as shoppers. Open-air markets are set up in convenient plazas on a designated morning. Before evening they have moved on and the street is washed clean.

are other long rivers. Brazil's rivers are valuable for transportation. They have enormous hydroelectric power potentialities for many rise on the plateau and drop toward the sea in high falls. Two falls are higher than Niagara—Iguassú Falls in a tributary of the Paraná on the Argentine border and Paulo Afonso Falls in the São Francisco. Few of the falls have been harnessed. A huge irrigation and power project on the São Francisco is under construction.

Climate and Rainfall

Since 93 per cent of Brazil lies in the tropics or low latitudes, its climate tends to be monotonously warm and humid, especially in the lowlands. In the plateaus and mountains the weather is cooler and more varied. Temperatures and rainfall totals both drop in the one-twelfth of Brazil south of the Tropic of Capricorn. Frost may come in winter. (See also South America subhead General Character of the Climate.)

Rainfall is abundant—even excessive. The trade winds bring moisture from the warm south Atlantic. Tropical showers fall on equatorial areas about half of the days in a year. The yearly average rainfall in the Amazon basin is 79 inches. Belém gets 100 inches and the fall is as high as 200 inches in places.

Summer—which comes between November and April south of the equator—is the rainier season and winter is the drier. The dry season is most pronounced in the western part of the plateau where coarse grass and scrub trees take the place of the dense rain forests of the north and east.

Seasonal temperature changes are small in the broad tropical part of the country. In Belém, near the equator, the annual mean is 78.6°F, with only 2.5°F average difference between the warmest and coldest month. São Paulo, near the Tropic of Capricorn at

2,700 feet altitude is cooler, with a mean annual temperature of 63.7° but even here the average difference between the warmest and coldest month is only 11.2°.

The Brazilian People and Their Culture

Brazil's population numbers 52,645,479 (1950 census preliminary). Three racial stocks have contributed to the make-up of the people and their culture—Indians, Negroes, and whites—the latter predominantly the Portuguese who colonized and ruled Brazil for three centuries. The republic has an international reputation for fine racial relations. Racial discrimination and segregation are rare and are punishable by fines and imprisonment.

Indians, the original inhabitants, now number only about 150,000. They live in the tropical Amazon basin. People of mixed white and Indian stock dwell there and in the upland back country or *sertão*. Negroes were brought as slaves to the sugar plantations of the northeast coast after 1533. By 1822 their number was estimated at nearly 4 million. Negroes and mulattoes make up about 60 per cent of the population of the northeast coast today. The population of the southern states is about 75 per cent white due to European immigration.

The Portuguese have played the largest role in the development of Brazil's culture. Cities built in colonial times are rich in Portuguese baroque architecture. Many structures are preserved as national monuments. The contribution of the Negro and the Indian is seen in art, music, dancing, and literature. (See also Latin America, section Culture, Recreation, and Education, Latin American Literature.)

The Portuguese gave Brazil its language and the Catholic faith. The celebration of church festivals has been influenced by Negro and Indian customs and

beliefs. The most elaborate of the many festivals is the pre-Lenten carnival in Rio de Janeiro.

How People Live in Brazil

Since Brazil is a varied country, its people live in various ways. The article Amazon River describes the life of the forest Indians. Rural life is most typical in Brazil, since four fifths of the people depend on agriculture for a livelihood. The single-family, farmer-owned farm of the United States is little known here. The average farm worker is a laborer on a big plantation or a sharecropper.

Large plantations have been the rule in Brazil since colonial times. The planters have sought big speculative profits from a single crop, such as sugar, cocoa, cotton, or coffee, raised with little expense. Instead of fertilizing their land and using improved cultivation methods and machinery, they wear out the land and move on or change to another crop.

When a plantation's crop brings high prices in the world market, the owner lives lavishly, with a big house on his land and another in the city. He travels abroad and sends his children to Europe for schooling. He may be wiped out when the price of his crop falls.

Plantation Laborer and Sharecropper

A big coffee *fazenda* is a community of several hundred or even several thousand persons. It has stores, repair shops, a flour mill, schools, churches, and perhaps a movie or amusement hall. The laborers and their families live in cottages provided by the owner. The families get land on which to raise food crops and animals. The men work in the coffee orchards and at tasks connected with curing the beans (see Coffee). The family and outside labor take part in the harvest.

Far less secure is the life of the people who work land for a share of the crop. A typical sharecropper arranges to move to a tract which the landowner wants

cleared. He builds a flimsy house of poles, lathed with bamboo, daubed over with mud, and thatched. He sets fire to the forest or scrub trees on the land. Next he opens holes amid the stumps with a hoe. His wife and children drop the seeds into the holes and press dirt over them with their bare feet. They usually plant corn, beans, sweet potatoes, sugar cane, cassava, upland rice, tobacco, and garlic. They grow two crops a year and raise a few hogs.

The tenant farmers help one another at weeding time or at harvest. For a big chore, such as building a house, everyone for miles around comes to a *mutirão*, which resembles the logrolling parties of the North American pioneers (see Pioneer Life). After the crowd has worked all day, the host serves refreshments and everyone dances the *jongo*.

When crops are good, the family eats well. The favorite foods of Brazil are beans, rice, sweet potatoes, fresh meat, and dried beef, called *charque*. The national dish is *feijoada*, a mixture of rice, beans, spices, sausage, and chopped meat, with cassava flour sprinkled over it. Food becomes scarce in two or three years when the land loses its fertility. The tenants plant grass and move on to fresh land, and the owner has a new pasture. These frontier families may never live where there are schools, newspapers, or other community institutions.

Life in the Cities

The cities are colorful and often beautiful. Plazas, parks, and avenues are lined with handsome churches, public buildings, and the mansions of the rich. Tropical plants clothe the hillsides, and even the humblest cottage is bright with flowers. Open-air cafes, parks, and beaches provide entertainment.

A middle class is growing up in the cities, as industry and trade call for skilled labor and white-

RUBBER AND RICE FROM THE HOT, WET AMAZON BASIN



This *seringueiro*, or rubber gatherer, is smoking the liquid latex he has taken from wild rain forest trees. The latex hardens into a big ball on the paddle and goes to market in this form.



Here a strip of forest has been burned over and rice is growing amid the stumps. This wasteful way of clearing land came from the Indians. The soil lacks humus and soon loses its fertility.

collar workers Skyscraper apartments and subdivisions have sprung up to house the well to do Most city people however are poorly paid unskilled workers Their low purchasing power retards business

Geographic Regions—the Amazon Basin

The world's largest rain forest in the Amazon basin is one of the world's most thinly settled regions (see Amazon River) It produces little of the nation's wealth today though it supplied the world's rubber for decades until competition by plantations in the East Indies began to ruin the wild rubber industry about 1910 The area includes the huge states of Amazonas and Pará and the territories of Amapá Rio Branco Acre and Guaporé The few inhabitants are Indians and mestizos who live by collecting forest products—latex Brazil nuts palm nuts babassu nuts and other oilseeds medicinal plants animal pelts and alligator skins Traders buy this produce at low prices and ship it by river boat to Manaus and Belém cities built in the rubber era

Cacao cassava beans rice yute and other tropical crops are raised on plantations and small farms but the cultivated area is small It is too hard to clear the tangled forest and keep down the springing growth The heavy rains leach the richness from the soil and yearly floods wash away the soil itself Health suffers from insects and tropical diseases

Efforts to raise rubber on plantations have been hand capped by lack of labor and by plant diseases Two huge experimental plantations established by Henry Ford were sold to the Brazilian government in 1945 The government is trying to attract settlers improve health conditions and find suitable crops

The Northeast

The great bulge of Brazil protruding into the Atlantic less than 2 000 miles from Africa was the

first part to be settled Coastal lands south of the bulge were fertile and drenched in rain Portuguese planters grew wealthy there raising sugar cane using Indian and then Negro slaves As population grew the people spread inland and along the coast north west of the bulge to a drier area Here they found tropical grasslands or savannas and semideserts of thorn trees and cactus called *catinga*

The people here use most of the land for pasture today Along the rivers where irrigation water is available they grow cotton sugar rice and beans Carnauba wax and cottonseed oil are valuable tree products Every few years drought strikes Migrants fleeing the drought have helped settle the country

The chief crops of the hot rain-swept sugar coast today are sugar cotton cacao rice tobacco castor beans oranges and pineapples Leading cities are Recife a busy port with cotton textile mills and Salvador where beautiful churches and other monuments of the colonial era are preserved Wells in Bahia produce most of Brazil's small output of petroleum Northeastern states are Maranhão Piauí Ceará Rio Grande do Norte Paraíba Pernambuco Alagoas Sergipe and Bahia

The Industrial Middle States

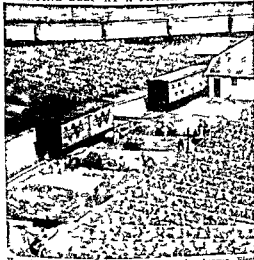
The wealthiest most highly developed part of Brazil fans out north west and southwest from the capital Rio de Janeiro across the states of Espírito Santo Rio de Janeiro Minas Gerais and São Paulo Here are the two greatest metropolitan cities—Rio and São Paulo the busiest ports—Santos and Rio most of the mines and factories the best rail and highway networks and the most productive farmlands Natural advantages contributed to its rise The fertile coastal plain has fine harbors while the broad plateau affords a livable climate and ideal temperatures rainfall and soil for coffee growing The Minas Gerais uplands are rich in minerals

The coastal plain was settled by sugar planters When gold and then diamonds were discovered in Minas Gerais in the 17th and 18th centuries settlers rushed in Gold and diamonds (especially industrial diamonds) are still produced here and the precious and semiprecious stones include aquamarines tourmalines imperial topazes and amethysts

The hope for the future lies in exploiting the vast reserves of industrial minerals in the Serra do Espinhaço—iron manganese nickel cobalt chrome and bauxite Development of the huge high grade iron reserve is retarded by distance from markets and the lack of coking coal Small iron and steel plants use charcoal for smelting Coal is brought north more than 700 miles by sea and rail for the big mill at Volta Redonda in the Paraíba Valley This mill was built during World War II with the aid of a loan from the United States Export-Import bank

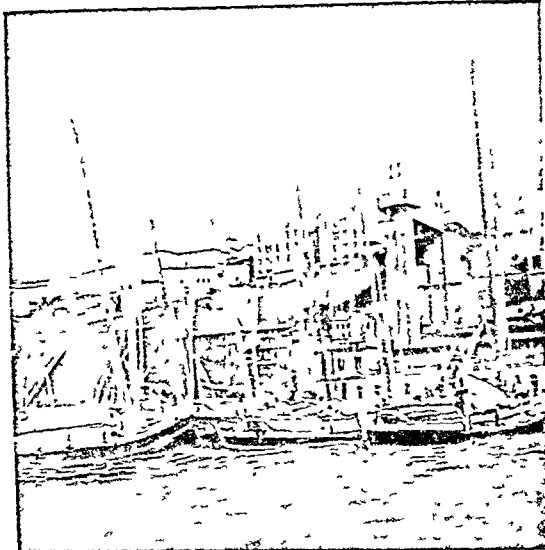
Rio had its rise as the shipping port for gold and became the colony's capital Famed for the beauty of its natural setting the city has become a commercial manufacturing political and cultural center (see Rio de Janeiro)

DRYING BEEF AT A PACKING PLANT

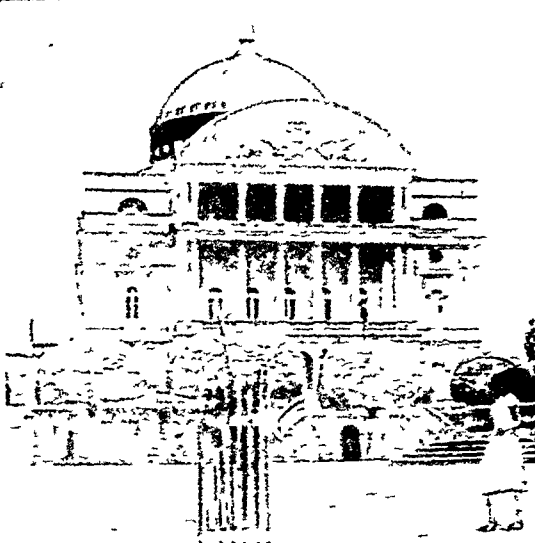


Here slabs of beef are drying on racks to make *charque*. First dried in bins and salted the meat keeps well. The name on the cars shows that the plant is owned by United States capital.

CITIES BUILT BY SUGAR AND RUBBER WEALTH



At Salvador, Bahia, in the northeast, the busy harbor is connected with the main city by elevator. The sailing vessels bring sugar, cotton, and other produce of the coastlands to the port.



This mammoth opera house at Manaus is a relic of the era when wild rubber from the Amazon basin poured wealth into this trading city. The mosaic sidewalks are popular all over Brazil.

The founding fathers of São Paulo were the *bandeirantes*, Portuguese adventurers who helped explore Brazil's vast interior and push back its western boundaries. Wealth came when the dark red *terra roxa* soil was found to be excellent for coffee. The state is the leading coffee producer and the crop is grown widely in Minas Geraes, Espírito Santo, and northern Paraná. Other commercial crops of the middle states include cotton, rice, sugar, and oranges. All raise cattle and fatten range stock from the backlands.

Wealth from coffee growing furnished capital for the swift industrial expansion of the 20th century that made São Paulo one of the fastest-growing cities. Its plants produce textiles, machinery, clothing, foods, beverages, chemicals, cement, glass, paper, rubber goods, and other products (*see* São Paulo).

The South

The three southern states—Paraná, Santa Catarina, and Rio Grande do Sul—have the same narrow coastal plain and rolling plateau as their northern neighbors, but they are different in many ways. The cooler climate of the middle latitudes means different natural vegetation and crops. Forests of *Araucaria* pine in Paraná and northern Santa Catarina are Brazil's leading sources of lumber. With them grows the *yerba maté* tree, whose leaves are sold in Paraguay and Argentina for maté tea. The prairies of the southwest are extensions of the Argentine pampa. Huge herds of cattle feed here under the eyes of picturesque *gauchos*.

The south is different too because the Germans, Swiss, Austrians, Italians, Poles, and Russians who settled here have marked it with their culture. In the towns stand houses like those of German or Polish villages. On the farms they raise their grain, vegetables, and meat as well as a commercial crop. The

produce includes cotton, sugar, rice, beans, onions, potatoes, tobacco, alfalfa, wheat, barley, rye, and grapes, with coffee in Paraná. Porto Alegre, the chief port and manufacturing city, has leather and meat-packing industries, textile factories, breweries, and wineries. Coal, mined in Rio Grande do Sul and Santa Catarina, is used here and shipped to northern industries.

"The Wild West"

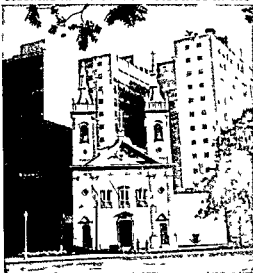
The huge, thinly settled states of Goiás and Mato Grosso on the western plateau resemble the old Far West of North America. This *sertão*, or back country, is mainly tropical pasture land. Some sections, however, have *terra roxa* and other fertile soils. Rich mineral reserves await development. Throughout Brazil's history efforts have been made to plant settlements in the region but many failed and disappeared. The vast distances to settled areas and the lack of adequate roads and railways help account for the delay in settlement. The cattle that run wild over the unfenced plains are rounded up and driven overland to distant cattle fairs, as the longhorns of the Far West were once driven over the old trails to market in the United States (*see* Cattle Ranching).

The federal government is offering inducements to displaced persons from Europe as well as to Brazilian settlers by establishing villages, called *nucleos*, where they are given work for a year and assigned land on credit. In the state of Goiás lies the huge federal district, set aside for a future national capital.

Trade, Transportation, and Communication

Brazil's economy is dependent upon agricultural production, though less than 4 per cent of it is under cultivation. Four fifths of its exports are agricultural, pastoral, and forest products. The leading

COLONIAL AND MODERN BUILDINGS IN RIO



Brazilians revere monuments of their colonial past, such as the church of St. Lucia, built in 1592. It was spared as skyscrapers mushroomed around it in Rio's 20th-century building boom.

exports are coffee, cotton, cacao, hides and skins, pine lumber, cotton textiles, carnauba wax, castor beans and tobacco. Despite the increase in manufacturing the country depends upon imports of machinery, vehicles, industrial chemicals, and pharmaceuticals. Fuels must be bought abroad in large amounts, since Brazil yields little oil and coking coal. The United States is the chief supplier and customer, with Great Britain and Argentina usually second and third.

Inadequate land transportation has handicapped Brazil. To build roads and railways over the Great Escarpment and through the forests is difficult and expensive. The best networks are in the southeast. Along the northeast coast the lines run inland only a few score miles from the ports (for map, see South America). Railway transport is hampered by varied gauges. Federal projects are on foot to improve railways and roads. The government hopes to extend dirt roads so trucks and buses can reach the rural areas.

Water transportation has been the leading method of moving goods in Brazil. Ocean ships connect the ports with one another and with the world. Navigable inland waterways are estimated at 26,000 miles.

Airlines have been extensively developed. Remote island villages have airports. They offer rural folk quick access to the settled coast, but they do not solve the problem of moving produce to market.

The federal government operates Brazil's telegraph and postal systems. Telephone systems are largely privately owned. Most radio and television stations are in the southern cities. Receiving sets are estimated at more than 1½ million.

Education and Government

Elementary education is free. It consists of five years of schooling, of which three are compulsory.

Rural schools offer only the first three grades and they have not spread to many thinly settled areas. In the last two decades secondary, technical, commercial, and vocational schools have increased. More than half of the adults cannot read and write, so in recent years adult education centers have been opened. Brazil has three federal, five state, and three Catholic universities.

The United States of Brazil is a federation of 20 states, 5 territories, and a federal district. The constitution of 1946 provides for the separation of powers among three branches—the legislative, executive, and judicial. The National Congress consists of two houses. The president is elected for a term of five years and may not re-elect himself. The states exercise all powers not delegated to the national government. The right to vote is limited to literate citizens over 18 years of age.

From Colony to Empire to Republic

Pedro Alvarez Cabral, a Portuguese navigator who landed at Porto Seguro on April 22, 1500, is regarded as the discoverer of Brazil, though Spanish navigators also saw the coast that year. Portugal had won rights of conquest to the area in 1494, under its Treaty of Tordesillas with Spain, and it ruled Brazil more than 300 years (see South America, section on Four and a Half Centuries of Eventful History). Brazil's name came from the red dye-wood called Brazilwood found there.

Brazil entered on the road to independence in 1508, when the Portuguese royal family took refuge there to escape the advancing armies of Napoleon. When King John returned to Portugal, his eldest son Dom Pedro was left as prince regent. In 1822 the Brazilians declared their independence and Dom Pedro was proclaimed their emperor. Thus Brazil was the only American nation to retain a monarchical government.

Under the benevolent despotism of Dom Pedro II, who ruled from 1840 to 1889, trade was vastly expanded, railroad building began, the population grew, and in 1888 slavery was abolished. In 1889 the empire was overthrown in a bloodless revolt, and

TRAINING INDUSTRIAL WORKERS



Here Ecuadorian scholarship students are learning the auto mechanic's trade in Rio's Senai school. The Brazil government and the International Labor Organization support this school.

Dom Pedro was exiled. A constitution for the republic was adopted in 1891.

In World War I Brazil was the only South American nation to declare war on the Central Powers. As an exporter of raw materials, the country suffered during the world depression beginning in 1929. Taking advantage of the economic crisis, Dr. Getulio Vargas seized the presidency by an armed revolt in 1930 and ruled as a dictator. In World War II, U-boat attacks on Brazilian ships led Vargas to declare war on the Axis in 1942 and to provide bases for the Allies. In 1944 the country sent the only South American combat force overseas. Vargas was forced to resign in 1945, and a new constitution was promulgated in 1946. He was re-elected to the presidency in 1950.

When wartime blockades cut off supplies of manufactured goods normally bought abroad, Brazilians

speeded their drive toward industrial self-sufficiency. By 1954 factory output in some lines had grown beyond the buying power of the people. Agriculture suffered from the movement of workers to the industrial centers. Purchases abroad of factory machinery, automobiles, and other luxuries had built up large foreign debts. The government placed restrictions on imports to balance trade.

Long-range plans were set in motion for a balanced improvement of the economy. The SALTE plan, which became law in 1950, dealt with improvement in health, foodstuffs, transportation, and power. The Brazilian-United States Mixed Commission sponsored a huge program financed by Brazilian funds and Point Four aid. It specialized on building and improving railways, roads, power plants, and grain storage and port facilities. (For Reference-Outline and Bibliography, see South America.)

Our DAILY BREAD and HOW It Is MADE

BREAD AND BAKING. Of all the things we eat, bread is the most important to the largest number of people. That is because it contains the largest share of the food substances essential to health for the least amount of money, and because most people like it so well that they eat it at every meal.

Bread is an excellent source of energy. It also contains minerals and vitamins, which build and repair the body. Without bread, larger quantities of the more expensive foods, such as eggs, milk, and fruits, must be eaten to maintain health. With bread, even the poor man can afford an adequate diet.

Bread of Other Lands

All over the world, as you read these words, millions of people are making bread. Much of the bread of other lands looks very different from the wheaten loaves or rolls that we know best. In Mexico and other American countries to the south, women bake coarsely ground cornmeal into flat cakes called tortillas (*tôr-tê'yās*). In Brazil they make similar little cakes from flour made from the cassava or manioc plant. In Scotland many people still prefer oatcakes or barley bannocks, baked on a griddle, to the finest wheat bread. In China and Japan much of the bread is made from rice flour, and in India from millet. And in Germany, the Scandinavian countries, and Russia, the chief breadstuffs are rye and barley, which grow better than wheat in most parts of these cold northern countries.

In the distant days when men first began to grow grain, they must soon have learned that porridge tasted better and kept longer if it was dropped on a hot stone and baked. At any rate, we can trace the history of bread far back to before the Christian Era. In the Metropolitan Museum of Art in New York City is a basket of bread baked about 3,500 years ago. It was found in a tomb at Thebes, where it had been buried with Hat-Nufer and Ra-Mose, husband and

wife, to nourish their departed spirits. Even older than this is a piece of bread discovered in the remains of a village of Swiss lake dwellers, who lived about 4,000 years ago.

The Story Behind a Loaf of Bread

To most people bread is just something that appears on the table at every meal. They take it for granted as they do a glass of water. A few nickels buy a loaf that lasts the average family a day or more. If they trace the familiar loaf back

to the seed planted by the farmer, however, they find a long trail leading through many processes and calling for the co-operation of many people. Grain must be grown, railways must transport the grain to the millers, and the millers must grind the flour. After the bread is baked, it must be hurried to the grocery store. And finally the grocer may deliver it to homes.

It has not always been so easy to get a loaf of bread. People used to have to grow their own grain,

GREAT BRICK OVEN OF SWEDISH PEASANT



On many farms in Sweden and Norway, baking day is a rare event. This Swedish woman is baking several months' supply of the rye and barley bread which is the great food staple in these northern lands.

mill their own flour and bake their own bread. In the United States bakery products did not begin to replace homemade breads until the turn of the 20th century. Even then most housewives did their own baking. People want their bread fresh and until the motor age made fast delivery possible commercial bakeries could not supply farms, villages and small towns with fresh wares. Today they make about 80 percent of all the bread consumed in the United States.

All breads belong to one or the other of two prin-

ci pal kinds—*leavened*

or *unleavened*. Leav-

ened bread contains

some substance which

generates bubbles of

carbon dioxide gas and

causes the loaf to rise

and become light and

porous. Unleavened

bread is dry and hard

throughout. Water

crackers, oatmeal bis-

cuits and Swedish rye

crisp are familiar ex-

amples of unleavened

bread. Ordinary bread

is leavened with yeast.

Biscuits, muffins, cakes

and other pastries

are leavened with bak-

ing powder or sour milk

and soda. A few

breads, such as beaten

biscuits, are leavened

by introducing air. (See Baking Powder, Yeast.)

Before it was discovered how to prepare yeast in concentrated form, part of the uncooked dough was saved from each baking to mix with the next. Between bakings this dough was soured or fermented by the wild yeasts in the air. When it was mixed with the fresh dough it caused the whole batch to ferment and rise. The ancient Egyptians were probably the first to discover this process, which is still used in parts of the world where other leavening agents cannot be obtained.

What Bread Is Made Of

Though bread is made from a long list of plants—including rye, barley, corn, oats, buckwheat, rice, millet and sorghum, potatoes, soybeans, peas, cassava, bananas, nuts and even alfalfa—the best and finest bread is made from wheat. Not only do most people prefer the taste and color of wheat bread, but a lighter loaf can be made from wheat than from any other cereal because it has more gluten. This is a sticky elastic substance which holds the gas bubbles produced by the yeast or the baking powder. Bread made from flour with little gluten is heavy. (See also Wheat.)

White bread lacks certain food elements that are present in whole wheat or graham, but it is more popu-

lar. People generally prefer the color and flavor resulting from the removal of the bran and the germ (see Flour and Flour Milling). White flour also makes lighter bread. Flour made from hard wheat makes lighter bread than soft wheat flour because it is richer in gluten. In the United States, rye and whole wheat breads are usually made lighter by the addition of a considerable amount of white flour.

In addition to flour, bread contains liquid, shortening, sweetening and salt.

Milk improves the flavor, appearance, nutritive value and keeping qualities of the bread. Most commercial bakers use milk in the form of dry milk solids, which are both cheap and easy to mix with the other ingredients. Shortening is usually lard, cottonseed oil or other vegetable oil. It makes the bread soft and tender. Sweetening may be cane beet or corn sugar or a combination of the three. It makes the crust brown, assists fermentation, and adds flavor.

Other ingredients used by commercial bakers are *dough conditioners* and *yeast foods*.

The commonest of these are malt and phosphates or sulphates of ammonium or calcium. They hasten the action of the yeast and aid in making the product uniform in texture and structure.

Self-rising Flour and Prepared Mixes

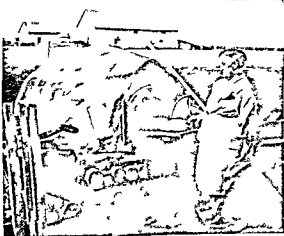
The first step in baking with baking powder is to mix it with the flour. Hence it was natural that someone should conceive the idea of saving the cook's time by marketing a flour with which the ingredients of baking powder had been already mixed. This flour is called *self-rising flour*. It is usually made with a soft wheat base and can be used in making any baked goods except yeast breads. Since the people of the South prefer hot biscuits and other quick breads, this kind of flour is a staple in most Southern kitchens.

Other time-savers are *prepared mixes*. They contain all the ingredients except the liquid. There are mixes for making pancakes, biscuits, pie crust, dough nuts, cakes and other baked products. Some *prepared doughs*, such as biscuit doughs, are all ready to be put in the oven.

How Bread Is Made in the Large City Bakery

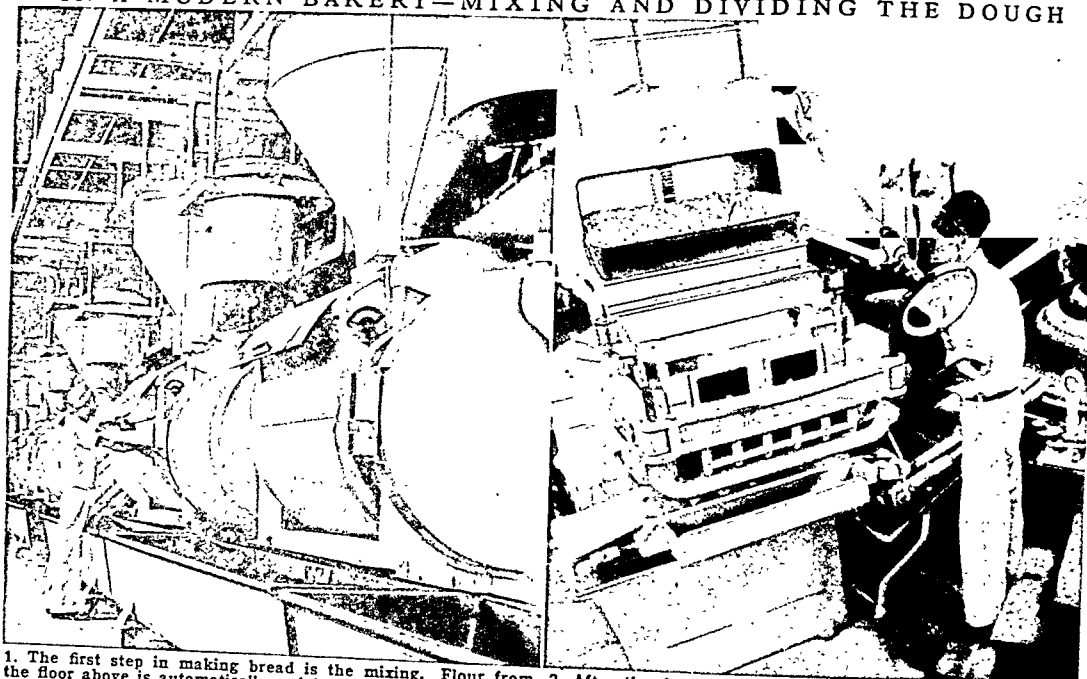
In the bakery of today, machines operated by skilled bakers do the work automatically. Nothing is left to chance. Ingredients are accurately weighed out. The temperature and humidity during the different

AN OUTDOOR OVEN IN QUEBEC



Outdoor ovens like this one, which is still in use on a Quebec farm, were once common in many parts of the United States and Canada. A fire is built on the oven floor, and when the temperature is right for baking, the ashes are raked out and the loaves are put in.

IN A MODERN BAKERY—MIXING AND DIVIDING THE DOUGH



1. The first step in making bread is the mixing. Flour from the floor above is automatically weighed through giant funnels into these great mixers. Here revolving metal arms mix a thousand pounds of dough at once. The dough then flows into the troughs already lined up and is taken in them to the fermentation room.

2. After the dough has fermented, it passes through the divider. This machine cuts it into pieces just the right weight for one loaf of bread. At the top you see the dough waiting to be divided. As it is cut into separate pieces, these drop to the belt below and are carried to the rounder at the right.

processes are closely regulated, and each process is carefully timed.

Since the flour must be *aged*, or matured, bakers used to store it in circulating air ten weeks or longer. The air worked slowly on the flour, bleaching it and improving its baking qualities. But now chemical bleaching agents accomplish this instantaneously, and flour can be used the same day it is milled. Most bakers, however, still store the flour for a short time to condition it.

Each baker uses a special *blend* of flour, produced either by mixing the wheat before it is milled or by mixing the flour afterward. If the baker does his own blending, the flour is sent to the blending bins on one of the top floors. Here the different varieties are mixed together in the desired proportions.

In most bakeries the manufacturing process starts at the top, so that gravity can draw the flour or dough from one machine down to the next. After a final sifting, the flour feeds into a scale which automatically weighs the right amount out into the *mixers* on the floor below. Water and other ingredients are then added. When the dough is mixed, it flows into huge troughs (pronounced by bakers to rhyme with "dough"), some as long as 12 feet. In these it is taken to the *fermentation room*. Here it is left to rise for several hours, until it is light.

In the *sponge dough* process only part of the flour is mixed with the liquid and yeast at first. When this batter, or sponge, has fermented sufficiently, the

remaining ingredients are added and the dough is allowed to *rest*, or rise, for a short time. In the *straight dough* process all the ingredients are mixed at the same time.

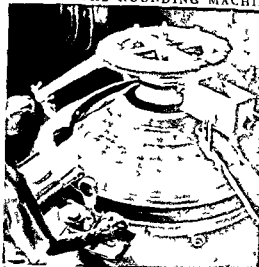
The *divider* then scales the dough into pieces of just the right weight for the pans. The *rounder* shapes the pieces into balls and drops them into buckets which move on a chain through the *overhead proofer*. Here the dough rests again for a few minutes while it recovers from rough handling in the divider and the rounder.

From the overhead proofer, the balls drop into the *molder*, where they are shaped to fit the pans. After the molded loaves are panned, they are placed on racks and rolled into the *proof box*. In this box they are given a final rise in slightly warmer, moister atmosphere than that of the fermentation room. They are then conveyed to the oven to bake at a steady temperature of more than 400° for about a half-hour.

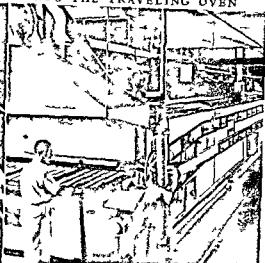
The most widely used ovens in large bakeries are reel ovens and traveling ovens. The reel oven resembles an enclosed Ferris wheel. In the traveling oven the pans move slowly on a conveyor through a long baking chamber, and the bread comes out baked at the far end. Some traveling ovens are more than 100 feet long and bake more than 5,000 loaves an hour. Low-pressure steam is injected into the oven to prevent the bread from crusting too quickly.

After the loaves have been gradually cooled, most of them are put through a *slicer* which cuts them into

FROM THE ROUNDING MACHINE INTO THE TRAVELING OVEN



3 This wild ring cone like machine is the rounder. It tumbles the pieces along a spiral track, shaping them into round balls and dusting them with flour before they slide to the oven head proofer. The operator is checking the weight of one of the balls.



4 The marvel of the modern bakery is the traveling oven. The operator feeds the pans on an endless hearth which carries them slowly through the long baking chamber. Through a door in the side of this chamber the progress of the baking is checked.

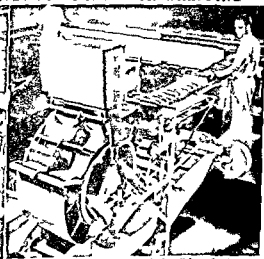
uniform slices. Finally the bread goes to the wrapping machine where steel fingers cut printed moisture-proof paper from a roll, wrap it around each loaf and fold it at the ends. The ends are then pressed against hot plates which seal the wrappers to keep the bread fresh and protect its flavor. Then in the early hours of the morning—for most bread is baked at night—the loaves are packed in trucks and carried swiftly to retailers near and far. The drivers of these

trucks are salesmen as well as drivers for most of them get a commission on all the goods they sell.

The Food Value of Bread

White bread and whole wheat bread rank about the same in most food values: low in proteins, high in carbohydrates and negligible in fats. The greatest difference is in mineral and vitamin content. (See Food Vitamins.) The milk in bread contributes considerable amounts of calcium and riboflavin (vitamin

BAKED AND SLICED THE LOAVES ARE READY FOR WRAPPING



5 The loaves have completed their long slow journey through the traveling oven and are sliding out at the end to be evenly baked. An operator removes them from the racks and stacks them on racks (not shown). The racks are then rolled into the cooling

6 After cooling, the loaves are ready for slicing. In this machine a series of rotating knives cut the loaf into uniform slices in such a way that it is not torn or squashed. A moving belt carries the sliced loaves to the wrapping machine.

B₂, or G). The wheat contains other important minerals and vitamins. These are chiefly in the bran and the germ. Most important are iron and the vitamins thiamin (B₁), riboflavin, and nicotinic acid (P-P). Thus many valuable food elements are lost when the bran and the germ are removed to make white flour.

Since many people do not get enough minerals and vitamins, the United States government has cooperated with millers and bakers in setting standards for "enriched" flour and bread to which minerals and synthetic vitamins are added. These standards require that a pound of this flour contain at least 1.66 milligrams of thiamin, 1.2 milligrams of riboflavin, 6 milligrams of nicotinic acid, and 6 milligrams of iron. The inclusion of certain amounts of vitamin D, calcium, and phosphorus is optional.

Flour may be enriched either by adding minerals and synthetic vitamins to white flour, or by so milling flour that the required amounts of the minerals and vitamins are saved, or by combining the two methods. Flour containing minerals and synthetic vitamins looks the same, tastes the same, and has the same baking and keeping qualities as ordinary flour. Flour produced by special milling is slightly darker.

Bread can be enriched by using enriched flour, by using high vitamin yeast, or by adding vitamin concentrates to the dough at the time of mixing. Six slices of this bread will supply from one-fourth to one-third of the daily requirements of these minerals and vitamins.

Other Bakery Products

Bread is only one of the many products the commercial baker offers. He also makes a variety of rolls, biscuits, cookies, crackers, cakes, pies, and other pastries. In making these, as in making bread, he follows special formulas and methods, and machines do much of the work. There are ingenious contrivances for molding and cutting them, for frosting and icing, for filling tubes of dough with pastes of various kinds, and for many other operations.

All cakes fall into two general classes—butter cakes and sponge cakes. Cakes that contain butter or some other fat are known as butter cakes. Those that contain no fat are called sponge cakes.

Butter cakes are made of fat, sugar, eggs, leavening, milk, flour, salt, and flavoring. Many varieties may be made by adding such things as chocolate, molasses, spices, nuts, and coconut.

Sponge cakes are made of eggs, sugar, flour, salt, and flavoring. Eggs furnish the liquid and also the air for leavening. Cream of tartar is added to make cake light and tender by making the walls of the air bubbles firm. Angel food and sunshine cakes are sponge cakes. Only the whites of eggs are used in angel food; in sunshine cake, both the yolks and whites are used.

Crackers and How They Are Made

Since its beginning little more than a century ago, the cracker industry in the United States has grown to be one of the largest branches of the baking in-

dustry. The first crackers were large, round, unsweetened, unleavened cakes, baked until they were very hard. They were somewhat like a water cracker. Because they kept better than ordinary bread and were more compact, they were in great demand for ship supplies and were called "pilot bread" or "ship bread." They were made entirely by hand, but, during the California gold rush, demand for this convenient food became so great that machinery was invented to roll the dough and stamp it into cakes. During the Civil War, the Army and Navy asked for such quantities of this "hardtack," as it was called, that an improved oven was invented. This invention increased the capacity of the bakeries several times. The familiar "soda cracker" and the soft "butter cracker" had also come into use by the time of the Civil War. These are made from raised dough and are lighter and more palatable than the hard cracker.

In England all crackers and biscuits, whether sweetened or unsweetened, soft or hard, plain or fancy, are called "biscuits." In the United States the term "biscuit" is applied to various forms of small sweetened and fancy cakes. The word "cracker" usually means a very thin, raised bread baked until it is dry, crisp, and brittle.

In making crackers as in making bread, most of the work is done mechanically. After the dough has fermented properly it goes to the *roller* which flattens it out into a sheet. The *cutter* then perforates it in the desired pattern. If salt crackers are being made, the sheet is sprinkled with salt. Finally it is carried to the oven on broad, long-handled paddles, called *peels*. The oven is usually a reel oven. When the crackers have baked thoroughly, they are cooled, wrapped, and boxed—ready for the consumer.

How the Consumer Is Protected

Since most consumers know very little about the bread they buy, laws have been passed for their protection. Since a large loaf may contain more air and not more weight than a smaller one, some states require that only loaves of certain weights be sold and that wrappers be labeled accordingly. The Food and Drug Administration limits the proportions of moisture and starch other than wheat flour in a loaf and specifies that only whole-wheat flour be used in making whole-wheat, or graham, bread. In 1952 it ruled against the use of chemical softeners in bread. Both state and federal laws prohibit deceptive trade names. Other consumer protections include labels telling the date of baking and listing the amounts of the various ingredients used.

Without these aids, consumers can judge the quality of a bread by noting some of its characteristics. Good white bread is creamy white, with a satiny sheen and no streaks. It is elastic in texture and fine-grained with no large holes. Its shape is symmetrical, its crust is evenly browned, and its flavor has no suggestion of yeast, sourness, or mustiness. Whole-wheat bread is slightly smaller for the same weight and should have a whole-grain flavor.

BREADFRUIT. The large globular fruit of this tree furnishes the chief food of the South Pacific islands. On various species of the tree the fruit ripens at different periods of the year thus affording an almost constant supply. The breadfruit tree—of which there are 40 species found throughout the tropical regions of both hemispheres—grows from 40 to 60 feet high, and is often limbless for half this height. It has large upper branches. The fruit, about half the size of a child's head, hangs from short, thick stems. It is first green, then brown. When ripe, it turns yellow.

In tropical regions where no grain is grown the natives rely upon breadfruit for their starchy food. They prepare it in many ways. Sometimes they roast it whole in hot coals, then scoop out and eat the inside. The taste is bland, somewhat like mashed potatoes. They also cut raw breadfruit into thin slices and dry these in the sun. The dried slices are then baked or ground into flour. Sometimes the breadfruit is stored in pits and allowed to ferment. After baking the fermented fruit has a pleasing flavor.

The tree requires a hot moist climate much rainfall and good drainage. It may be introduced to new tropical regions by transplanting cuttings of small branches. Breadfruit played a part in British naval history when the British ship *Bounty* sailed in 1787 to Tahiti under Captain Bligh to gather breadfruit cuttings for transplanting in the West Indies. The voyage ended (April 28, 1789) in a famous mutiny.

From the fibrous inner bark of the tree a cloth is made and from the wood canoes and furniture. The sticky milky juice which exudes from cuts in the stem is used in making a kind of glue.

The breadfruit tree belongs to the *Moraceae* family which also produces the orange. A somewhat similar though inferior fruit is produced by the jack (*Artocarpus integrifolia*) growing in India, Ceylon and the Eastern Archipelago. It is much eaten by natives in India.

BREAKFAST CEREALS. The modern breakfast cereals, whether brown and crisp and ready to serve from the package, or meant to be cooked into a delicious steaming hot dish, make the first meal of

the day quite different from the usual breakfast of only a few years ago. Then oatmeal porridge, cornmeal mush, boiled cracked wheat or perhaps the old English dish frumenty made by boiling wheat kernels with milk and spices were practically the only cereal foods used. The modern breakfast

foods by making breakfast a simple light and wholesome meal have done much to improve the diet of all civilized countries especially for children.

This great change in the breakfast menu has developed an enormous industry. Every year new forms of breakfast cereals cooked or uncooked are placed on the market. We have breakfast foods flaked, malted, shredded, ground, cracked, rolled and puffed. The Department of Agriculture of the United States tells us how they are prepared.

The ready-to-eat brands are prepared in a great variety of ways. Some are probably simply cooked in water and then dried and crushed. Some are made of a different mixture of grains, some have common salt, malt, and apparently sugar, molasses or other carbohydrate material added



Here are fruits of the breadfruit tree amidst the glossy leathery leaves. The leaves grow to be from one to three feet long. The fruit is formed from female flowers clumped together. In the picture we can see that the shell of the fruit is mottled; that is covered with fine prickly points.

to them some probably contain caramel or other similar coloring matter. Those with a flaky appearance are made like rolled grains, save that the cooking is continued longer. Those which look like dried crumbs are probably made into a dough, baked, crushed and browned. The shredded preparations are made with special machinery which tears the steam-cooked kernels into shreds and deposits them into layers or bundles. Very many of the ready-to-eat cereals are parched or toasted before packing. This gives them a darker color, makes them more crisp, and imparts a flavor which many persons relish.

The puffed grains are most ingeniously made. Kernels of the grains are thoroughly cleaned, then they are placed in a gun-like cylinder and cooked with live steam. When the kernels have become thoroughly saturated with this exceedingly hot steam, they are shot from the cylinder into very cold air. Puff—the heat within the kernels bursts the cells and swells the grains to several times their natural size—

"shot from guns," in the familiar words of the advertising slogan invented by some ingenious writer.

Processing the Morning Meal

The first cereal breakfast food was probably made from oats, and that grain is still used more than any other. Let us follow the modern process by which it is changed to the familiar "rolled oats."

First the oats are cleaned and the ends snipped off. Next comes roasting, the most important part, for this releases the oil in the tiny cells to flavor the whole grain. Roasting is done in a kiln drier, where hot air from below blows the grains about in the air: or in a machine similar to a coffee roaster; or sometimes simply in open pans over a fire. After roasting, the oats are passed through rollers which slip off the hulls. Softened by steaming, the grains, or "groats," as they are now called, pass between big polished steam rollers that flatten them into flakes. Then they are poured into boxes, sealed by machinery, and dried in sufficient heat to kill any lurking germs.

Breakfast cereals are rich in carbohydrates (chiefly starch) and proteins. Those made from whole grains contain minerals, especially phosphorus, calcium, iron, copper, and manganese. They also contain vitamin B₁ (*thiamin*), which prevents beriberi and other nervous disorders. The vitamin content of some prepared cereals is further enriched by the addition of thiamin, and by ultra-violet irradiation to supply vitamin D, which prevents rickets.

BREMEN (*brä'mən*), GERMANY. Forty-six miles from the North Sea, up the broad Weser River, stands Bremen, the oldest seaport of Germany. Near the outskirts of the city spread the sandy dunes of Germany's northwest coast. These neighboring dunes led to the name of Bremen (originally spelled *Bremun*), which means "on the boundaries."

As a gateway from the sea into the north German plain, Bremen early became a center of North Sea commerce. By the year 787 the town was important enough to have a bishop. In 1346 it established its independence and joined the Hanseatic League. As a "free city" and the capital of a state of 99 square miles, Bremen established its own commercial agreements with foreign nations and set up counting-houses abroad (see Hanseatic League). In 1646 Ferdinand III, Holy Roman emperor, confirmed the position by naming it a "free imperial city."

It was the first German community to make a treaty of trade and friendship with the United States. This was in 1827. That same year Bremen founded the town of Bremerhaven at the Weser's mouth to receive vessels too large to sail upstream. Commerce with the United States spurred Bremen's growth. It became Europe's chief port for emigrants and a major market for tobacco and other American products. In 1871 the "free city" gave up most of its privileges to join the German empire. It lost the remainder in 1935 when it passed under Nazi rule.

Even as Bremen grew into one of the largest cities of Germany, it preserved its historic color. The spires of the cathedral of St. Peter, begun in the

11th century, dominated the commercial district. A statue of the knight Roland, raised in 1404, guarded the Renaissance town hall, where wine aged in the cool cellars. Public gardens bloomed from the ramparts and moats that had encircled the medieval town.

Modern commerce and industry brought miles of docks and railway tracks, shipyards, and huge blocks of iron foundries, engineering works, and factories for other heavy industries. During the second World War these industries became the target of more than a hundred Allied air raids, which wiped out parts of the city. It fell to British troops in 1945. In 1949 the state of Bremen (including Bremerhaven) became a *land* in the new Federal Republic of Germany. Population of city (1950 census), 444,549.

BREST, FRANCE. "He is not master of Brittany who is not lord of Brest," was a saying in the 14th century. The saying might be extended to include all northern France, for Brest occupies the tip of the great peninsula of Brittany which commands the approaches to the English Channel on the north and the Bay of Biscay to the south. Rising on the slopes of two steep hills, divided by the Penfeld River, the city overlooks a magnificent landlocked bay.

Its strategic position made Brest a prize in many wars. French and English fought several naval battles there in the 17th and 18th centuries. In 1631 ambitious Cardinal Richelieu improved the harbor. From time to time, the French added new fortifications, and soon it became one of the chief naval bases of France and the seat of a naval academy.

During the first World War Brest served as the chief port of the American Expeditionary Force. After the war it became a port of call for transatlantic vessels. It served also as a terminal for a submarine cable to America.

Most of its industry was devoted to supplying the French fleet, building ships, and manufacturing munitions. It also produced flour and chemicals and prepared quantities of mackerel and sardines.

The foggy, rain-drenched city was occupied by the Germans in 1940. In the harbor they built gigantic concrete-covered pens for the fleet U-boats that preyed on Atlantic shipping. Brest then became a major target of Allied air raids. Tons of bombs shattered the harbor works. When the Allies invaded northern France in 1944 the German garrison in the well-fortified city was able to hold out for nearly seven weeks. Brest was virtually leveled to the ground, but as soon as peace came many of the city's people returned and started rebuilding from the ruins. Population (1946 census), 62,707.

BREWSTER, WILLIAM (1567-1644). As a student at Cambridge, William Brewster first came in contact with the Puritan ideas which made him one of the leaders of the Pilgrim Fathers. While in the service of William Davison, ambassador to Holland, he made several trips to Holland. Later, Brewster returned to his home village of Scrooby to take over the office of "post." His duties involved sending mail, keeping the inn, and supplying horses for the

post roads. He and his wife Mary had five children: Jonathan, Love, Wrestling, Patience, and Fear.

Earnest men and women who had formed a Separatist church at Scrooby gathered secretly for devotions in the Brewster manor house. They wanted to worship in their own way instead of conforming to the Church of England. Brewster, who was an elder in the congregation and several others were imprisoned before all fled to Holland in 1608. At Leyden the scholarly Brewster supported his family by teaching English and printing religious books outlawed in England. He helped obtain a patent from the London Company for land in Virginia, but chance brought him with his 102 exiles to Cape Cod instead (see "Mayflower," Plymouth Mass.). During that first winter of 1620-21 which wiped out nearly half the colonists, Brewster was one of the seven strong enough to care for the sick and bury the dead.

BRIAND, ARISTIDE (*brě-ān ā-res tēd*) (1862-1932)

If you had dropped into a certain French country inn one September day in 1906 you would have seen two men lingering over their coffee talking like old friends. These men you are amazed to learn are the French and German foreign ministers. The stooped, untidy-looking one with shaggy gray hair and drooping mustache is the French minister, Aristide Briand, who has arranged the little party.

The luncheon is typical of Briand's diplomacy. Back in Paris politicians are bickering across the border statesmen are worried. Briand remains calm but impatient with the stilted methods of statecraft. He is a fascinating talker. When a tense moment arrives he relieves it by telling an amusing story. Sometimes his light blue eyes are lazily half shut. Sometimes they sparkle brightly with wit and irony. There is something profoundly tranquil about this man you observe and something cynical. He looks as if he has met with everything in his experience, believes anything possible but thinks only a very few things important. Late into the afternoon these two men talk and when they finally go off arm in arm together the way has been paved for an agreement in which France and Germany both make wide concessions in the interest of peace.

Briand was born at Nantes in western France on March 28, 1862. He was educated for law but preferred journalism. He wrote political articles for radical publications and with Jean Jaures founded the newspaper *l'Humanité*. He became a leader of the

French Socialist party and in 1902 was elected to the Chamber of Deputies. Supremely sane, he could perceive instantly the essentials of a question, stripped of details and could present any problem simply.

As chairman of a committee to draft a law for separation of church and state, he issued a report that became the basis of the separation law. In 1906 he was appointed minister of public instruction and worship. After the Socialist party expelled him for accepting a portfolio in a conservative ministry, he drew his support from the more conservative groups. He became minister of justice in 1908 and in 1909 premier—a position he was to hold more often than any other man in French history. His government fell in 1910 and another in 1911. He was minister of justice in 1912, premier for a month in 1913, became minister of justice again in 1914 and from October 1915 to March 1917 during the first World War he held the difficult double post of premier and min-

TOLERANT PEACEMAKER



Aristide Briand is shown as he signed a treaty with Spain in 1920 after the R. R. war in Mexico. This pose was typical of him. His long career as premier of France was devoted to the cause of peace.

ister of foreign affairs with but one interruption.

He assumed his previous double post in 1921 and bent every effort to bring France and Germany into harmony.

At the 1921 naval disarmament conference in Washington, foreigners thought he presented the French demands very ably but at home the Nationalists denounced him for not being firmer with reparations and enforcement of the Versailles treaty. England warned against a too harsh policy, and Briand, seeing also the dangers of severity, tried to reconcile French and British views but his enemies forced him to resign just at the close of the allied conference.

at Cannes in 1920. In 1920, he was minister of foreign affairs again and that year saw the fulfillment of one of his dreams when a series of peace and arbitration pacts was signed at Locarno by Germany and her former European enemies.

Soon thereafter French finances reached a deplorable state and ministries rose and fell. From Nov. 28, 1925 to July 17, 1926, M. Briand formed three different cabinets. He was premier again in 1929. During all this time except three days in 1926, he was minister of foreign affairs.

He was defeated for the presidency in 1931 because of dissatisfaction with his foreign policy. He shared the Nobel peace prize of 1926, was co-author of the Kellogg-Briand Peace Pact renouncing war as an instrument of national policy and was the author of a plan for a United States of Europe.

The MAKING and the LAYING of BRICK and TILE

BRICK AND TILE. The story of bricks carries us back to the dawn of civilization, for almost as soon as men began to erect temples and palaces, they learned that a cheap and durable building material could be obtained by molding clay into rectangular "mud pies" and allowing them to harden, either in the sun or in artificial heat. Kiln-burned bricks made by the Babylonians 6,000 years ago still exist, and the entire site once occupied by the vanished city of Babylon is little more than a huge mound made by the breaking down and dissolving of the former huts and houses of sun-baked brick.

The ancient Egyptians had an inexhaustible supply of brick-making material in the clay which forms the bed of the river Nile, and brick making was always one of their chief industries. Because this clay lacked tenacity, the Egyptians used to add chopped straw or reeds, which served to bind the bricks together. You remember how the children of Israel during the mournful years of their bondage in Egypt were set at making bricks, and how the cruel taskmasters added to their woes by requiring them to make "bricks without straw"; that is, ordered them to furnish their own straw without diminishing the quantity of bricks produced in a given time. The Egyptian bricks were nearly all sun-dried, not kiln-burned, like the *adobe* bricks of Mexico and the southwestern part of the United States. Adobe bricks can be used where there is no frost to freeze the moisture in them and crack them.

An Important Modern Industry

Today brick making is one of the world's great industries. Nearly every community of any size has its own brick plant, unless it has an abundant and cheap supply of other building materials close at hand. The industry is widely scattered because bricks can be made of almost any kind of clay, mixed with sand. Brick clay consists largely of hydrated silicates of aluminum, with oxide or carbonate of iron, and various other substances. When they are burned, bricks of this composition have a buff, salmon, or red color, due to the presence of the iron. If much

carbonate of lime or chalk is present, the color is sulphur-yellow. If sand is not already present in the clay, it must be added. If there is too much sand the bricks are likely to crumble, and if there is too little the bricks will easily crack.

Preparing the Clay

Clay for bricks is dug by steam or electric shovels, crushed by hammer devices or rollers, and sifted to remove rocks or other bulky material. Then the screened clay, sometimes with anthracite coal dust added to promote burning, is mixed with water and kneaded thoroughly by great revolving knives in a "pug-mill." Modern practise uses one of three machine systems—the soft-mud, the stiff-mud, or the dry-clay machine. The stiff-mud process is most commonly

used in the United States. As the clay is forced out in columns it is cut by wires, 18 bricks at a time. Some machines turn out 300,000 bricks a day.

Workmen then pile them on cars, perhaps 1,000 on each, which carry them through tunnel driers that remove nearly a pound of moisture from each brick in 24 hours. The tunnels are heated by exhaust from the kilns, and the air is kept dry by ventilation. If the air should get too

damp, moisture from the interior of the brick comes to the surface, carrying with it the soluble salts of the clay, which cause the white scum seen on poorly dried bricks.

In the soft-mud process, machinery presses the mixed clay in molds, and the brick is not as hard or durable as the stiff-mud brick.

For the expensive dry-pressed brick, clay almost dry is pressed in steel molds. This type is used for artistic front-wall finishes, or decorative interior work. Sometimes brick is dried in the open air, or on steam-heated floors.

Strengthening the Brick by Fire

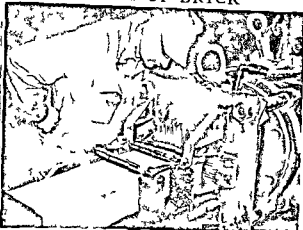
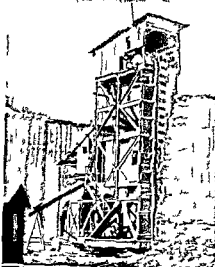
The next step is the all-important burning, in which the chemical properties of the clay are changed to give it strength and durability. In the continuous car kiln, the brick passes on fire-proof cars through tunnels 300 or 400 feet long, from a preheating zone

PLYING A TRADE THAT IS CENTURIES OLD

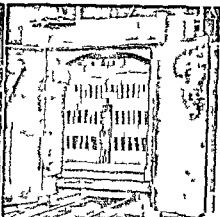
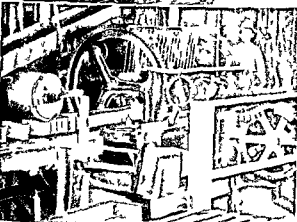


These brickmakers near the ancient city of Nineveh still mix clay from the bed of the Tigris with weeds for a binder, and set the molded bricks out in the hot Mesopotamian sun to dry, just as was done in the days when Nineveh and Babylon were flourishing cities.

STEPS IN THE MANUFACTURE OF BRICK



The shoveler cuts shaf from the face of a deposit and drops it into a bin. Then trucks carry the shaf to a pugmill. In the pugmill the clay is mixed with water kneaded and forced out in a column above. The shoveler levels the column.

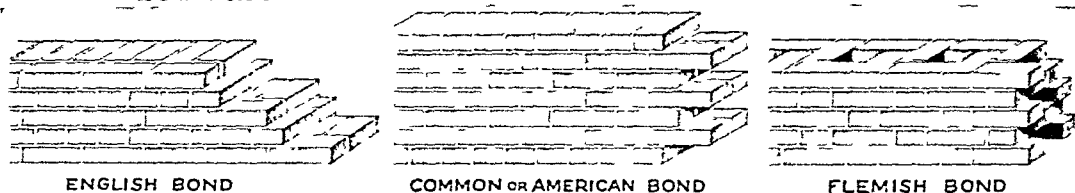


The column of clay passes over the cutter table (left) where it is cut into bricks with revolving wires. The big roller separates the cut bricks. They are then loaded into the kiln car (right) and pushed through the tunnel kiln to be dried and burned.



The finished bricks are removed from the oven (left). The modern brick kiln shown at the right is in Chicago, Ill. In these circular kilns fire passes up through the walls to the arched roof and is turned down to burn all parts of the bricks.

HOW BRICKS INTERLOCK TO FORM STRONG SOLID WALLS



ENGLISH BOND

COMMON OR AMERICAN BOND

FLEMISH BOND

Of the many patterns or "bonds" used by bricklayers, these three are the most favored. The English bond consists of alternate courses of lengthwise bricks (stretchers) and crosswise bricks (headers). A course faced with stretchers is backed, as you can see, with headers, and vice versa. This interlocks the front and back of the wall. In the American, or common bond, five or six courses of stretchers are laid front and back, then a course of headers across the thickness of the wall. Flemish bond is made with alternate headers and stretchers in each course, staggered front and back to form hollow squares.

to the furnace or burning zone, then to a cooling zone. For common brick, the temperature of the furnace runs to about 2,100° F. Coal, oil, or gas are the usual furnace fuels.

In the circular or oval kiln, fire passes up through the walls to the arched roof and is shot down upon all parts of the bricks. Sometimes, especially in Europe, bricks are piled to form their own kiln. As many as 3,000,000 bricks may be burned in one such "clamp," and it is kept burning from two to six weeks.

Machines Do the Work

In modern plants, bricks are piled by hand only once, when they come from the brick machine, and are stacked on cars to go through the drier. Mechanical "setters," with finger-like projections, which fit in spaces between the bricks in the two lowest rows, lift 1,000 bricks at a time to build kilns of 1,000,000 or more bricks. These kilns are daubed with clay on the outside to retain the heat; oil burners at ground level blow in oil with a jet of steam. At first, the oil is ignited by "targets," or torches, just inside the wall; as the heat increases, the wall becomes hot enough to fire the oil, and the targets are withdrawn. The heat, rising in a V-shaped cloud, requires about 72 hours to reach the top. Experienced kiln men know by the color of the outside wall how the heat is rising, and seldom use gauges. A 1,000,000-brick kiln will cool in two days.

Bricks for Special Purposes

Facing, or face brick, for prominent parts of buildings, is re-pressed before being dried. This process squares the corners and edges and gives a smooth surface. Tapestry brick has a design pressed on the brick in the mold. Fire brick is made of clay with little or no fusible materials. Special high-refractory bricks, made to withstand the terrific temperatures and the sudden heating and cooling in certain manufacturing processes, contain zirconia, magnesia, chromite, or other minerals. The "high alumina brick" used for great temperatures is made chiefly from diaspore or from crystalline alumina. Glass manufacturers make a fine refractory (heat-resisting) brick by melting the materials in an electric furnace and pouring the liquid into molds. Lime is added to paving, or vitrified brick, for extra hardness.

Bricklaying Methods

The strength of brick masonry depends as much upon the manner in which the bricks are laid as it

does upon the quality of the bricks used. They must be interlocked or "bonded" so that they cling together stoutly. For this purpose bricks are usually made about twice as long as they are wide. The common dimensions in America are $2\frac{1}{4} \times 3\frac{3}{4} \times 8$ inches. The patterns of the three most common "bonds," pictured above, illustrate how these dimensions fit the methods of laying.

A brick laid lengthwise of a wall is called a "stretcher"; a crosswise brick is a "header"; and any horizontal row of bricks in a wall is a "course." Bonding, therefore, is an arrangement of stretchers and headers, planned so that headers link the front and back of a wall. The bricks in each course overlap those below, so that joints never line up vertically. Several types of bonds are used to achieve different patterns. The lines in a pattern may be emphasized by bricks in contrasting colors.

A "bat" is the name for a brick broken in half. When used to fill out a course at a corner it is a "closer." Bricks are sometimes set vertically, as in porch posts. The stretchers are then called "Soldiers" and the headers are known as "rowlocks."

Mortared joints usually make up about one-seventh of a wall. They are almost as important as the arrangement of the bricks for the appearance and the durability of the work. The color of the mortar should bring out the fine tones and shades of the brick. The size of the joints also affects this color relation, for they range from thin "battered" joints to some an inch wide. Joints may be tooled into various shapes, raked out, or cut flush.

For the best results, bricks must be damp when laid. A mechanical bricklayer, which permits a worker to put down 8 or 12 bricks at once, has been developed. With it one man can lay from 2,000 to 3,000 bricks a day, several times the usual number.

The Use of Face Brick

Face brick is popular for both exterior and interior work because it is made in a wide variety of surfaces and colors that lend themselves to decorative purposes. Face brick is used chiefly for the outer shell of a wall; behind it is usually a heavy supporting wall of common brick to supply the strength the face brick lacks. In such construction an air space is left between the two walls. This keeps out moisture, cold, and heat, and so serves to make buildings warmer in winter and cooler in summer.

Smooth or semi smooth face brick of light bronze, golden buff tan reddish, or pearl tones is popular for houses. In kitchens and similar rooms face brick coated with enamel or a salt glaze is often used. For fireplaces rough or smooth textured face brick may be chosen to suit the taste of the home builder. But face and common bricks are widely used for garden walls, arched gateways, walks and driveways.

Brick paved sidewalks, streets and highways once common have largely given way to asphalt or concrete which provides a smoother surface.

Clay Tile and Its Uses

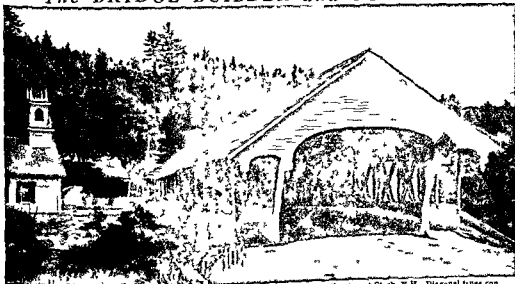
Glazed earthenware drain tile an important contribution to civilization, was invented by Sir Henry Doulton (1820-1897), an English potter. This tile made it possible for the first time to carry off sewage effectively. Previously, the best drains were

of brick through which some seepage was certain to occur and pollute the soil. Such tile also made it possible to drain swamp lands.

Tile is made in much the same way as brick in a variety of shapes and patterns. Pottery drain and sewer pipe (vitrified tile) unglazed or common drain tile hollow tile for chimneys and fire-proof walls and partitions are made by machines that squeeze soft clay through openings of the desired size or shape producing tubes or other forms which are then cut into standard lengths, dried and burned in a kiln.

Tiles for roofs, floors, walls and decorative purposes are made of clay pressed into metal molds, fired, decorated and glazed. Unglazed tiles in patterns of different colors are often used for floors. A fine decorative tile of especially pure clay called *encaustic* (colored or painted) tile is made for walls.

The BRIDGE BUILDER and HIS WORK



Soon after the Revolution Americans began to build covered bridges similar to this one at Stark, N. H. Diagonal trusses construction at the ends supported the bridge. Sometimes the bridge used an arch like the one seen through the trusses here for reinforcement. Many people believe the roof was built to protect the bridge from snow or to provide shelter for travelers. Engineers agree, however, that the men who built these bridges added the overhead beams for strength, then put the roof on the cover or roof to keep the timber framework dry so that it would not rot and to give it resistance against the wind.

BRIDGE A tree trunk placed across a stream made a foot bridge for primitive man. If the stream was too wide to be crossed by one tree, he might build a pile of stones in the middle for a support. Then he could build his bridge as long as two trees laid end to end. A vine growing over a ravine made another early kind of bridge. Men could swing across on this hand over hand. Presently men learned to weave strong vines into a bridge like a hammock hung from bank to bank. As civilization developed, people wanted bridges big enough and firm enough for horses and carts. Railroads required long bridges over rivers and gorges. These had to be strong enough to carry the tremendous weight of trains. Automobiles made wide smooth highway bridges necessary.

Men have learned through the years how to build long strong bridges. Yet many hard problems challenge the engineer when he is planning a great bridge. How wide is the water or gorge to be spanned? Can more than one kind of bridge be built there? If the cheapest kind possible calls for supporting piers in the water, can a firm foundation be laid? Will currents, tides and possible storms weaken the piers? Construction time is important, since cost is a factor.

Next the engineer must plan the approaches to each end of the bridge. If land is expensive as in cities, the approaches will have to be short. This fact may determine what kind of a bridge can be built. Many questions arise in planning details of construction. Samples of steel are tested in machines that pound

the samples with monstrous weights, and that bend, twist, and draw them out, to make sure that every part of the bridge will "stand up." One weak part could wreck a whole bridge. The planner must consider forces other than loads. Heat expands bridges; cold contracts them; unless correct allowances are made, one summer or winter day can reduce a bridge to scrap metal. Strong winds wrestle with the bridge, adding 50 or 60 pounds a square foot to its burden. Soldiers marching in step on a bridge might set it swinging.

Do You Like Adventure? This Is the Life for You

If you like adventure, consider the life of the bridge builder. You may have to battle storms and currents placing foundations in a river. A railroad may send you into a wilderness, making approaches. Or consider the men who build the bridge itself. They ride great beams swung up to lofty positions by puffing derricks; others climb about the framework and run out on beams far above the water, placing, riveting, hammering, until the whole structure hums like a busy beehive. Suspension bridge workers, like human spiders, must spin every single wire in the mighty cables singly across the river.

Every bridge gives engineers and builders some new problems to work out. Especially interesting are the movable bridges constructed so as to permit large ships to pass. Some, called bascule bridges, are divided in the middle and tilt up like the blades of a jack-knife. Of this type, the most famous example is the Tower Bridge at London. In others a central span turns on a pivot, or is lifted up the sides of towers. Such bridges are operated by electric machinery. The "pontoon" bridge, floating on boats, is built for temporary use, particularly by armies, and also as a permanent structure. There are bridges of this type over Lake Washington, at Seattle, and over the Golden Horn, at Istanbul (Constantinople). The Seattle bridge has a draw span and reinforced concrete pontoons. The Turkish bridge has steel pontoons and a movable center section. Here and there we still see picturesque covered wooden bridges built a century or so ago. Many medieval bridges were built with shops and houses on each side of the roadway, as in the still standing Ponte Vecchio of Florence and the London Bridge of nursery fame.

Roebing's Fight for Suspension Bridges

For spanning the greatest distances, the *suspension* bridge, with a roadway hung from huge cables swung between supporting piers, is champion. John A. Roebing spent a lifetime convincing people of this. They were doubly doubtful when eminent engineers said that his railroad suspension bridge, opened across the Niagara gorge in 1855, was "shaky." Later, when New York City and Brooklyn decided to have a bridge over the East River uniting them, Roebing persuaded them to let him try his suspension idea. Years passed, while foundations were sunk and wires were spun. In the meantime Roebing died; but his son finished the job in 1883. For over half a century the mighty

bridge carried an endless stream of heavy traffic. In 1950 reconstruction was begun to modernize it.

Suspension bridges, however, are extremely costly. One reason is that strong foundation piers are needed. Another costly job is spinning the main cables. This is done by spinning wheels, which travel across the space on temporary cables, dragging lengths of wire behind them, until all the wire needed has been spun. The wires then are pressed and bound to form cables; suspender cables are hung from the main ones; and finally the roadway is hung from the suspender cables.

The Ingenious Cantilever Bridge

Next in spanning capacity is the *cantilever* bridge, which has a unit called a truss in the center, and units called cantilevers at the ends. The secret of this bridge is the action of the cantilevers.

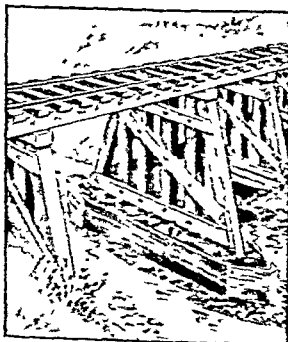
Later in the article a picture of the Quebec Bridge shows that each cantilever is a double-ended bracket which rests at its center on a solid pier. Hence it tends to rock, seesaw fashion, when weight is applied at either end; for example, the weight of the truss tends to push down the inner end of each cantilever, and to tilt up the shore end. But the cantilevers cannot move because the shore ends are well anchored: and so the truss is held securely in place.

The great advantage of this plan is that, in general principle, each unit need only be strong enough to do its share, and the bridge costs much less than if it had a single unit strong enough to span the entire space. The same principle applies in the Carquinez Strait Bridge shown later in this article. It has not only two end cantilevers, but also a center cantilever, which holds the inner ends of two trusses balanced against each other.

Arches, Trusses, and Girder Bridges

After the cantilever comes the *arch* bridge, with its ingenious way of gaining strength (see Arch). The Romans built stone arch bridges, but 50 feet was the limit of their spans. Today, steel makes huge spans possible. Arched bridges of reinforced concrete or masonry are often used for beauty, where cheaper types would do.

For short spans the simple *girder* bridge, with straight steel members, is commonly used. For somewhat longer spans a *truss* may be used. The members

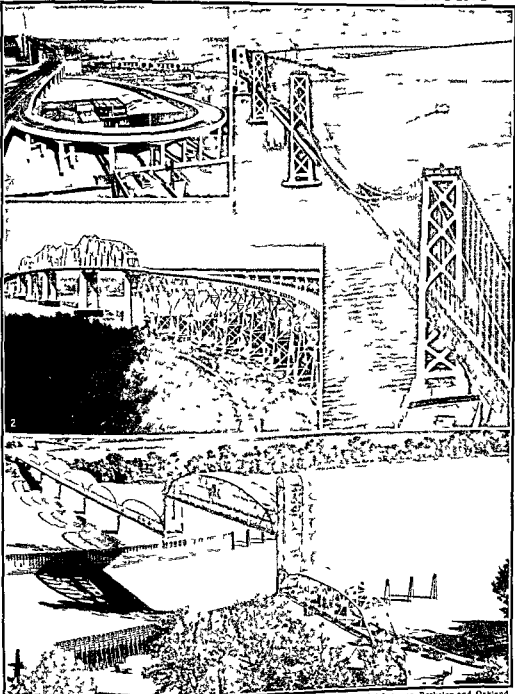


A Trestle Bridge

of a truss are arranged in triangles, because triangles can be altered in size or shape only by breaking the metal. Often the truss is arched top or bottom for added strength.

Triangles also are used to strengthen trestlework, made of timber. A *trestle* consists of several up-rights, with diagonal braces placed across

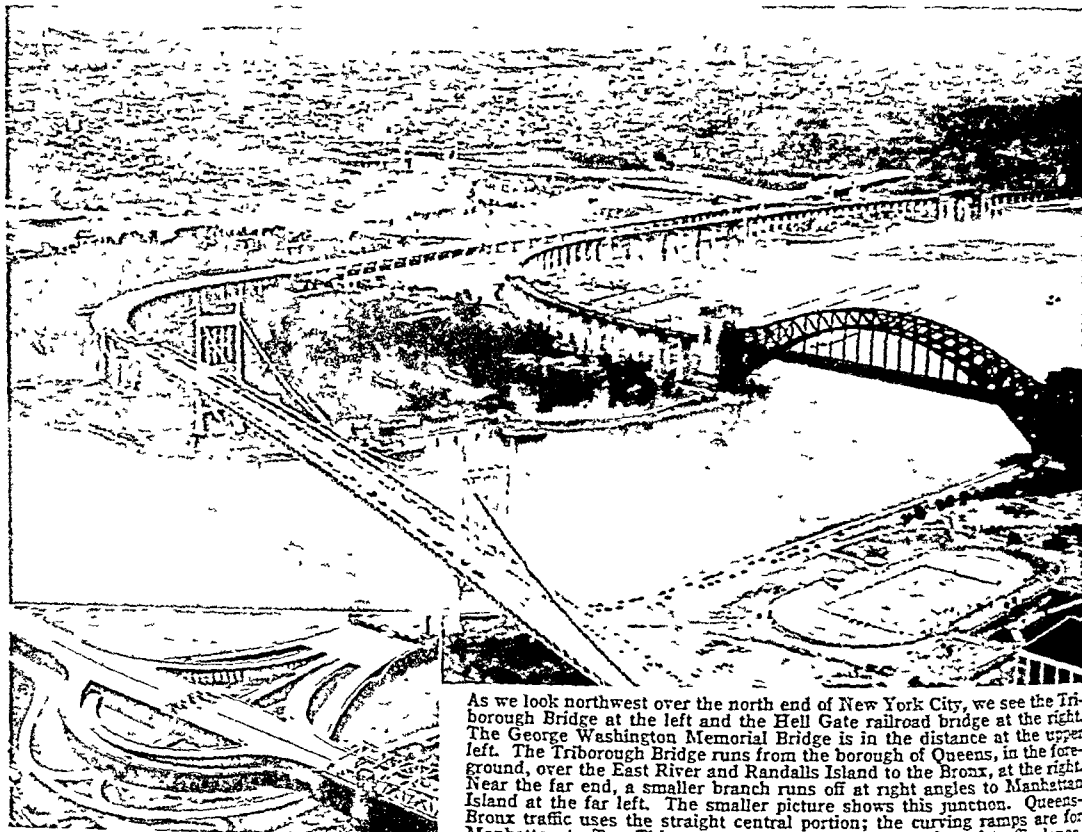
THREE MODERN TRIUMPHS OF BRIDGE-BUILDING



In the upper pictures we see the once supposedly 'impossible' feat of bridging San Francisco Bay actually accomplished. The left-hand view (1) shows a winding approach in San Francisco to the San Francisco Oakland Bay Bridge which rises high above the waterfront and the shipping on mighty suspension spans (picture 2) and passes through Yerba Buena Island in a tunnel. A cantilever unit trusses and girder spans complete the connection

with the east shore at a point between Berkeley and Oakland. The left-center picture (2) shows the Huey Long cantilever bridge across the Mississippi at New Orleans. The bottom picture (3) shows a vertical lift bridge over the Illinois River. The lift provides passage for towboats and barges on the Great Lakes to the Gulf Waterway; the screen-like structures keep the towed barges from bumping into the bridge as they swing in the current.

THE HUGE TRIBOROUGH AND HELL GATE BRIDGES IN NEW YORK CITY



As we look northwest over the north end of New York City, we see the Triborough Bridge at the left and the Hell Gate railroad bridge at the right. The George Washington Memorial Bridge is in the distance at the upper left. The Triborough Bridge runs from the borough of Queens, in the foreground, over the East River and Randalls Island to the Bronx, at the right. Near the far end, a smaller branch runs off at right angles to Manhattan Island at the far left. The smaller picture shows this junction. Queens-Bronx traffic uses the straight central portion; the curving ramps are for Manhattan traffic. This structure eliminates all crossing of traffic lanes.

the uprights and at the sides to form triangles. This economical construction made railroads possible in thinly settled regions in the 19th century.

Noted Bridges of the World

The champion of all bridges for length of its main span is Golden Gate Bridge over the entrance to San Francisco Bay. This huge suspension bridge, completed in 1937 at a cost of \$35,000,000, has a span of 4,200 feet between its main towers. It clears high water by a minimum of 220 feet. Cold and lack of a load can raise the roadway 10 feet.

San Francisco also has the world's longest bridge in total length, the San Francisco-Oakland Bay, or Transbay, Bridge across San Francisco Bay. This bridge, opened in 1936, is $8\frac{1}{4}$ miles long with approaches. It includes two suspension bridges, each with 2,310-foot main spans, and a cantilever bridge with a 1,400-foot span. It cost \$77,200,000.

The Mackinac Bridge across the Straits of Mackinac between the peninsulas of Michigan, when completed, will have the world's second longest main span, 3,800 feet. Construction on this suspension bridge, begun in 1954, will cost about \$99,800,000.

The third greatest suspension bridge in the world is the George Washington Memorial Bridge over the Hudson River between New York City and Fort Lee, N. J. Its main span is 3,500 feet. It was opened in

1931 and cost \$60,000,000.

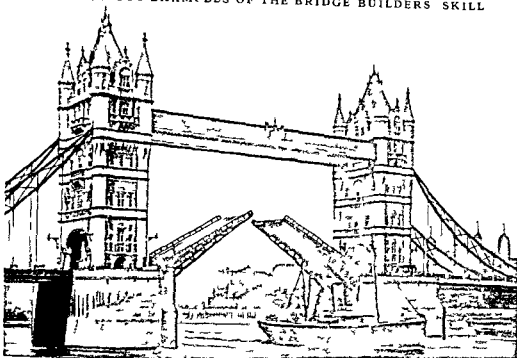
The cantilever bridge with the greatest main span (1,800 feet) is Quebec Bridge over the St. Lawrence River. Scotland's Firth of Forth Bridge has the second longest clear cantilever span, 1,700 feet. The Howrah cantilever bridge across the Hooghly at Calcutta, India, has a span of 1,500 feet.

The longest steel arch bridge is Bayonne Bridge over Kill van Kull between Bayonne, N. J., and Staten Island, N. Y. Its main span of 1,652 feet is 2 feet longer than that of Sydney Harbor Bridge in Australia. Sando Bridge over the Angerman River in Sweden has the longest concrete arch main span, 866 feet.

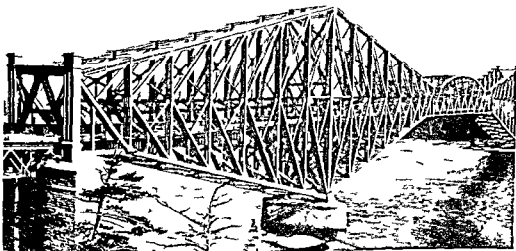
Other fixed bridges with lengthy main spans are continuous-truss Julien Dubuque Bridge over the Mississippi between Iowa and Illinois, 845 feet; simple-truss Metropolis Bridge over the Ohio at Metropolis, Ill., 720 feet; and plate-girder Dusseldorf-Neuss Bridge over the Rhine in Germany, 676 feet.

Movable bridges with great main spans are Cape Cod Canal vertical-lift bridge in Massachusetts, 544 feet; Fort Madison swing-span bridge over the Mississippi at Fort Madison, Iowa, 531 feet; Sault Ste. Marie bascule bridge in Michigan, 336 feet; and Lake Washington Floating pontoon bridge in Washington, 202 feet. (See also in FACT-INDEX bridges by name and the Bridge table.)

TWO FAMOUS EXAMPLES OF THE BRIDGE BUILDERS SKILL



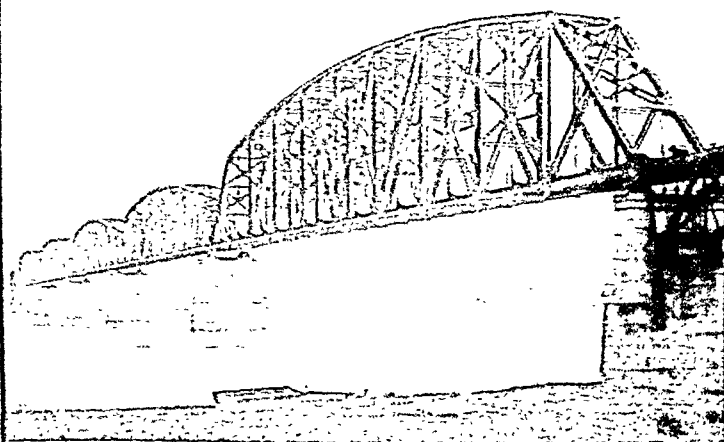
This is the famous Tower Bridge over the Thames at London. As you pass over the driveway it has the solid appearance of an ordinary paved street. Yet when a ship approaches this driveway splits in the center and the two bascules swing up smoothly and easily as if the two great towers were giants slowly lifting the arms. Meanwhile foot passengers can climb the towers and cross to the upper bridge. The bascule bridge has become popular in many American cities where a comparatively narrow shipping channel is spanned.



For spanning great distances the cantilever type of bridge has proved extremely successful. This famous railway bridge at Quebec with a span of 1,800 feet, is perhaps the longest of its kind in the world. It is built in three sections, consisting of two huge brackets balanced on piers and connected in the middle by a short truss. Such bridges can be built out from the balancing piers without a scaffolding to hold them up for the network of braces makes them self-supporting at each step of the work.

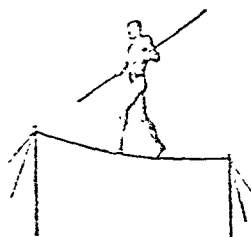
MAN'S MANY INGENUOUS WAYS OF

THE BRIDGE THAT STRADDLES LIKE A LOG



The Burlington Railroad's bridge (left) over the Ohio River at Metropolis, Ill., shows us how men use "trusses" to carry a roadway, like a log, between supports built in a river. Each structure between the piers is a "truss." The article tells how a truss works.

THE BRIDGE THAT WALKS A TIGHT-ROPE



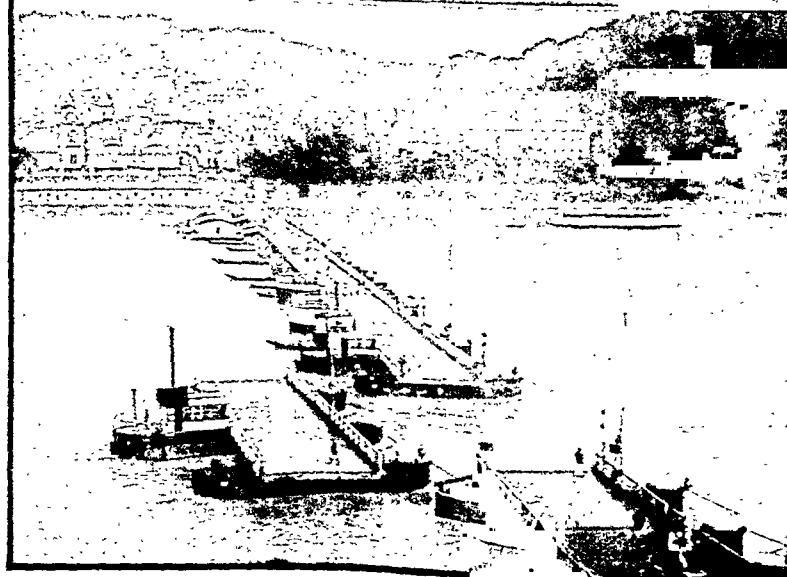
The gigantic Golden Gate suspension bridge north of San Francisco shows how a bridge high enough to let the largest ships pass is "hung from ropes," to cross very wide bodies of water.



THE BRIDGE THAT FLOATS ITSELF ACROSS



We may say that a "pontoon" bridge is like a lumberjack jumping from log to log in a river. Its roadway crosses on floating boats. At the left is a pontoon bridge that crossed the Rhine River at Coblenz, Germany. Notice how a steamer is taking away a section to let a river boat pass through. This bridge was destroyed in the second World War.

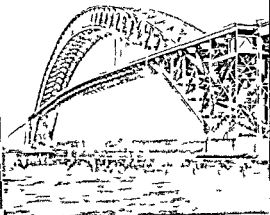


CARRYING HIS ROADS OVER RIVERS

THE BRIDGE THAT HUMPS ITS BACK TO CARRY A HEAVY LOAD



Just as workmen arch their backs to carry heavy loads, so do bridges. At the right we see how the huge steel arch of the Bayonne Bridge crosses the Kill van Kull from Bayonne, N. J., to Staten Island. The arch is carried high enough so that the roadway can be hung below and still let ships pass under. The concrete Cappellani Memorial Bridge at Minneapolis below has the roadway carried over the three arches.



THE BOOK-SHELF BRIDGE



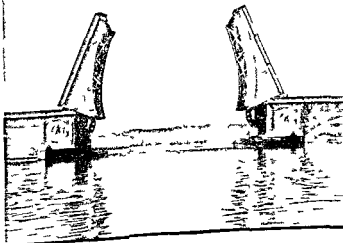
At the left the brackets stand out clearly in the cantilever bridge over Carquois Strait at the northeast corner of San Francisco Bay.



THE BRIDGE THAT FOLDS LIKE A JACK-KNIFE



When a river boat approaches a bascule bridge machinery whirs and up go the two leaves like jack-knife blades to let the boat pass. A counterweight concealed here balances each leaf so that it moves easily. We are viewing the splendid Arlington Memorial Bridge over the Potomac River between Washington, D. C., and Arlington Va. Another noted bascule bridge is shown on page 309.



BRIDGEPORT, CONN. Excellent transportation, many skilled workers, and a wide diversity of products make Bridgeport one of the leading manufacturing cities of New England. It is the industrial capital of Connecticut, and the third largest city in the state.

Bridgeport is situated at the mouth of the Pequonock River, on Long Island Sound, 56 miles northeast of New York City. It has two harbors busy with the coming and going of coastwise steamers and tow barges, which carry a tremendous volume of domestic freight. The port has complete customs facilities, and many imports are received in bond from New York City and other Atlantic ports. Main line railroad service and motor truck lines speed Bridgeport products to all parts of the nation. A large airport is equipped to handle passenger and freight service and serves as an auxiliary field for New York City.

Bridgeport got an early start in metal-working industries. Sewing machines were manufactured here as early as 1856, and now one of the largest companies making these machines has an immense plant here. A munitions plant and a large aircraft factory played an important role in Bridgeport's war production. The city's long list of manufactures also includes electrical goods and appliances, office equipment, machine tools, fabricated metals, brass products, transportation equipment, instruments, apparel, automotive equipment and supplies, engines, cable, and wire.

Bridgeport, with more than 1,166 acres of parks, is known as the Park City. It has miles of beach along Long Island Sound and fresh-water lakes within the city limits. Pleasure Park is an amusement center and bathing beach. Beautiful 210-acre Seaside Park with 2½ miles of sea wall was a gift largely from P. T. Barnum, who made his home in Bridgeport (see Barnum).

Among the city's many schools are the University of Bridgeport, the Bridgeport Engineering Institute, the Fannie A. Smith Teacher Training School, and a technical school. The municipal public library is the largest system in the state.

The first settlement was in 1639 on land bought from the Paugusset Indians. It was called Pequonock, or "broken ground," because of the near-by rolling hills. The fine harbor soon made it a trading center. In 1800 it became a borough of the neighboring town of Stratford, and in 1836 it was incorporated as the city of Bridgeport. About 60 per cent of the working people of the area are employed in its more than 500 industrial plants. Population (1950 census), 158,709.

BRISTOL, ENGLAND. The dignified old city of Bristol has from the dawn of its history been a trading center. Although located eight miles from the Severn at the junction of the Frome and Avon rivers, it can be reached by large vessels, thanks to the improved river channel and the immense docks along the Severn, and millions of dollars' worth of exports and imports pass through it every year. The city has long been noted for its glassworks, potteries, soapworks, tanneries, tobacco factories, and shipyards.

About the year 1000 a Saxon settlement began to grow up at the junction of the two rivers, and by the time of the Norman Conquest, in 1066, it had attained considerable size and importance. From Bristol the Cabots sailed on their voyage to explore the New World found by Columbus. Bristol fishermen settled Newfoundland, and it was the home of Admiral Penn, father of the founder of Pennsylvania. It was also the home of the poets Coleridge and Southey, and many landmarks recall the former glories of the town. Supreme among these relics is St. Mary Redcliffe, called by Queen Elizabeth I "the fairest, the goodliest, and the most famous parish church in England." This church was built in the 13th century, while the cathedral dates back to the middle of the 12th. Some of the schools date from the 16th century. Bristol University (chartered 1909) is a noted educational center. The university and other parts of the city were heavily bombed during World War II in an effort by the Germans to ruin the city as a port. Population (1951 census, preliminary), 442,281.

The SUNSET PROVINCE of Canada

BRITISH COLUMBIA, CANADA. The "Sunset Province" faces westward across the Pacific Ocean and south to the United States. Lofty mountains cut it off from the rest of Canada to the east.

In spite of its isolation, this most British of all the provinces has developed a thriving industry and agriculture. The magnificent scenery of its mountains and coast line, the abundant fish and wild game make it a tourists' paradise—the "Evergreen Playground." Lumber mills and salmon canneries, mines and smelters point to a wealth of natural resources. On the dry interior plateaus are great cattle ranches. In the irrigated valleys and the rich

Extent.—North to south, about 800 miles; east to west, about 450 miles; area, 366,255 square miles. Population (1951 census), 1,165,210.

Natural Features.—Chief mountains: Rocky Mountains; Coast Range; highest peak, Mount Fairweather (about 15,300 feet), on Alaska border; lowest point, sea level. Chief rivers: Fraser, Thompson, Columbia, Kootenay, Skeena, Stikine, Lizard, and Peace. Products.—Lumber, pulp and paper, processed fish, meat, petroleum products; milk, cattle, eggs, apples, hay, hogs, poultry; zinc, lead, copper, coal, gold, silver; salmon, herring, halibut. Cities.—Vancouver (344,833); Victoria (capital, 51,331); New Westminster (28,639); Trail (11,430); Pemberton (10,548).

delta of the Fraser River are apple orchards, grain fields, and truck gardens.

British Columbia is larger in area than California, Oregon, and Washington combined. Yet its population is one twelfth

that of the Pacific coast states. Three fourths of the people live in the lower Fraser River valley and on Vancouver Island. British Columbia's population density of 3.24 persons per square mile is lowest of any province except Newfoundland. Forested mountains and plateaus cover most of the province. The Rocky Mountains lie on the eastern boundary and the Coast Range on the west. Between them is a high plateau carved by long, narrow, parallel valleys.

THE FRASER RIVER CANYON NEAR NORTH BEND

Only the northeastern corner of the province the Peace River district lies east of the mountains in the Great Plains (see Peace River)

Mountains and Plateaus

The Front Range of the Rockies rises to 13 000 feet along the Alberta boundary. Snow-crowned Mount Robson sweeps 12 972 feet above sea level. Dark forests alpine meadows blanketed with flowers silvery waterfalls glaciers and gemlike lakes give these mountains rare beauty. Yoho and Kootenay national parks and Mount Robson provincial park embrace some of the most spectacular sections.

West of the Rockies is the Rocky Mountain Trench. It varies in width from 2 to 15 miles and extends northwest the length of the province at an average elevation of about 2 400 feet. This is an area of weak rocks which sank as the mountains rose on either side. In this great trough rise most of the province's rivers—the Columbia Fraser Kootenay the Finlay and Parsnip which join to form the Peace River and the head streams of the Liard.

West of the Trench are several different ranges—the Selkirk the Purcell Mountains the Monashee and to the north the Cariboo Mountains. Mount Revelstoke and Glacier national parks are in the Selkirks. These ranges are separated by long narrow trenches similar to the Rocky Mountain Trench which they join in the north. Motorists can now travel from Banff and Lake Louise in Alberta across the Rockies to Golden and then on the new Big Bend Highway to Revelstoke. The highway follows the course of the Columbia River north in the Rocky Mountain Trench around the Selkirks and south in the Selkirk Trench.

The Interior Plateau and Coast Range

The Interior Plateau extends for 500 miles north-west and has an average width of about 100 miles. The Fraser River and its tributaries the Thompson Chilcotin Nechako and other rivers have carved long narrow valleys into the plateau. Cattle grazing is the chief industry of the dry uplands. The river valleys particularly the Okanagan and Kootenay in the south, are intensively cultivated under irrigation.

The Coast Range on the west of the plateau rises in sheer cliffs from the Pacific Ocean. Nowhere in the world is there a more beautiful coast line than in British Columbia. Rivers and glaciers carved deep canyons into the mountain sides. Then the coast sank



Between Hope and Lytton on the Fraser River is the world's most beautiful canyon enclosed between the great slopes of the Coast Range. This scene shows the historic Cariboo Road between the great slopes of the Coast Range. The scene shows the historic Cariboo Road between the great slopes of the Coast Range. The scene shows the historic Cariboo Road between the great slopes of the Coast Range.

permitting the sea to advance far inland forming fjords like those of the Norwegian coast. Some of these fjords are 2 500 feet deep and their walls are 2 000 to 5 000 feet high.

Scenic Inside Passage

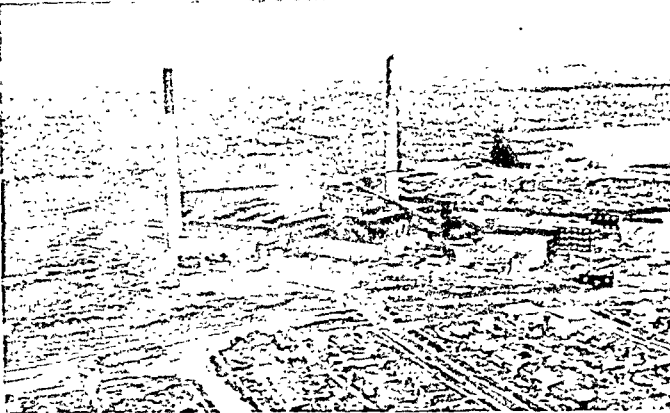
The coast is bordered by a chain of islands. Vancouver Island and the Queen Charlotte Islands are the largest. They are the exposed tops of a submerged mountain range. Between the islands and the mainland is another valley like the Rocky Mountain Trench. The sea has poured into it forming the famous Inside Passage. Protected by the forested islands on the west from the winds and storms of the open Pacific it is a route of incomparable scenic grandeur from the United States to Alaska.

Only in the southwestern corner of the province is there a combination of mild climate, generous rainfall, deep rich soil, level land and good harbors. The lower Fraser River valley is a rich flood plain of about 900 square miles. At its mouth is Vancouver, western Canada's chief seaport and third largest city (see Vancouver). New Westminster on the Fraser is a busy industrial center. Vancouver Island with Victoria, capital of the province at its southern tip, supports prosperous farms and cities (see Vancouver Island, Victoria, British Columbia).

Extremes of Climate and Rainfall

To wake up in Vancouver on a winter's morning after traveling by train from the east is a surprising experience. Over night one has left behind the snow the bitter cold the whining winds of the high plateaus. Here on the coast people pick flowers at

THE GREAT TRAIL SMELTER

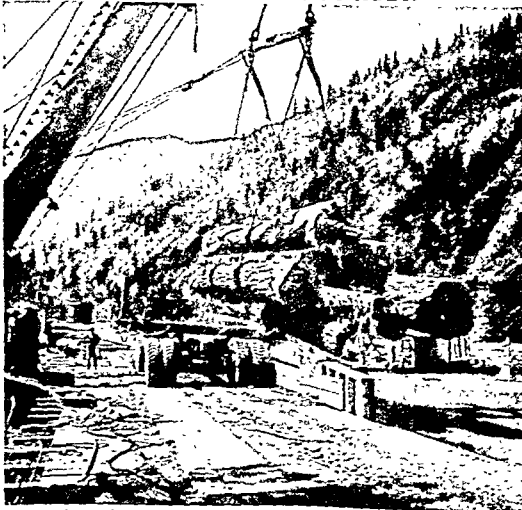


The Trail smelter, just north of the United States border, is the largest in the British Empire. It receives ores from the Sullivan mine, producer of lead, zinc, and silver. Mining and smelting are among British Columbia's leading industries.

Christmas time, and vegetables still grow in the gardens. By the end of February, winter is over.

Along the coast flows the warm Japan Current. The prevailing westerly winds are warmed by the current and bring moderate temperatures to the coast both winter and summer. In rising over the mountains the winds cool and lose their moisture. Rainfall on the western slopes is heavy and fogs are frequent. East of the Coast Range a series of wet and dry belts result from interference by parallel mountain ranges. Some parts of the interior plateau are near deserts with an annual rainfall of less than 10 inches. The valleys of the Columbia-Kootenay region have a dry, invigorating climate, with an annual rainfall of 18 to 20 inches. In the far northern section of the plateau temperatures range from 60 degrees below zero to 100 degrees above. The Peace River country

LOGGING ON THE FRASER



These huge logs have been cut from the eastern slopes of the Coast Range near Hope on the Fraser River. They are being dumped into the river to float down stream to the mill.

enjoys a more moderate climate because of its lower altitude.

Rich Natural Resources

The rain-drenched western slopes of the Coast Mountains are covered with magnificent forests of coniferous trees (evergreen softwoods). The constant moisture, long growing season, and mild temperatures with no extremes of cold or heat produce huge trees. The largest and most important commercial species is the Douglas fir, rivaled in its height and girth only by the California redwoods. The interior forests yield hemlock, red cedar, and balsam fir. In the quantity and value of its lumber and sawmill products, British Columbia leads all the provinces, with about 50 per cent of the total output. Lumbering is strictly regulated by law.

British Columbia has the most valuable fisheries in Canada, accounting for about 40 per cent of the total production. The Inland Passage swarms with millions of fish. From May to September the salmon return from the ocean to their spawning grounds up the inland rivers. Salmon are by far the most valuable of

Canada's fish, and British Columbia produces practically all the catch. The Fraser River has the largest "runs." To enter the river the fish must pass through many miles of United States waters. The fishery is for this reason one of international concern. The many problems involved are handled through the International Pacific Salmon Fisheries Commission. In 1946 this commis-

sion completed the building of fishways through Hell's Gate Canyon on the Fraser River for the purpose of restoring the salmon runs to their former size. The expense was shared equally by both nations.

Halibut are taken around the Queen Charlotte Islands. The International Fisheries Commission regulates the catch. Pilchards and herring are abundant in the waters off Vancouver Island.

Minerals are widely distributed throughout the province. The Sullivan mine near Kimberley produces 96 per cent of Canada's lead and 55 per cent of its zinc, and is the largest producer of silver in the nation. The ores are sent for refining to the smelter

A LOADED SALMON BOAT



The salmon fisheries on the Fraser River are among the world's largest. This fisherman is bringing a net full of fish aboard his small trawler.

at Trail the largest in the British Empire

British Columbia owes its early settlement and development to the gold rushes of the middle 19th century. The Fraser River and Cariboo areas were famous for their gold deposits. The largest mines today are on Vancouver Island and near Kamloops. Copper is mined on Howe Sound north of Vancouver and at Copper Mountain near the Washington border. Vancouver Island has large coal beds.

Limited Farming Area

Only a small part of this mountainous province is

suitable for farming—about 32 000 square miles out of a total area of 366 255 square miles. Cultivated land is confined to the warm southern valleys: the Fraser River delta, Vancouver Island and the Peace River area. The leading field crops are hay, clover, alfalfa, oats, spring wheat and potatoes.

The mild climate of the Okanagan and Kootenay regions in the southeast is ideal for fruit raising. British Columbia leads all the provinces in the value of its tree fruits, especially apples. The entire crop is marketed by various cooperative agencies. The lower Fraser River valley and Vancouver Island specialize in raising berries, tree fruits, vegetables and flower bulbs and dairy cattle. Beef cattle raising is the chief industry of the dry interior plateaus of the Chilcotin, Kamloops and Cariboo regions.

Varied Manufacturing

Its wealth of natural resources and nearness to the sea make British Columbia the third province in industrial importance, following Ontario and Quebec.

CATTLE RANGE IN THE CHILCOTIN AREA



This cattle country near the Chilcotin River is typical of parts of the Interior Plateau. The rolling upland range lands are broken by the wooded foot hills. The cattle are shipped to meat packing centers in the lower Fraser River valley.

The greatest producers of wealth are the many saw mills and the great paper and pulp mills. During the second World War shipbuilding increased enormously and took first place in value of output, but lumber products are usually first. Next in importance is fish-curing and packing, based principally on the salmon fisheries. Salmon canneries account for one-third of Canada's total fish processing industry. Other industries include meat packing, fruit and vegetable canning, printing and publishing, and manufacture of bakery goods, butter and cheese, brewery products, petroleum, feeds, sheet-metal products and fertilizers.

Most British of the Provinces

About 63 per cent of the population of British Columbia is of British descent. Next most numerous are people of Scandinavian, German, French, Dutch, Ukrainian and Russian origin. There are about 75 000 Indians, 16 000 Chinese and 7 000 Japanese.

Chinese were brought to the province in the 1880s to build the railroads. Japanese soon followed. At

APPLE ORCHARDS IN THE OKANAGAN VALLEY



The Okanagan River valley in the southeast of the province, with a mild but dry climate and rich soil, is special area for raising apples and other tree fruits under irrigation. The Kootenay and Arrow Lake regions to the east are also fruit raising areas.

VANCOUVER AND ITS MOUNTAINOUS SETTING



This view of Vancouver looks northward to the snow-capped Coast Range. Beyond the skyscraper buildings in the background, visible at the right, is Burrard Inlet, Vancouver's busy harbor. The white tower in the center is the City Hall. Vancouver is Canada's leading seaport and third largest city.

first they provided cheap labor. As their numbers increased, measures were taken to restrict further immigration. Asiatics numbered 41,000 at the outbreak of the second World War. The Japanese were interned during the war and many moved to other provinces.

Education and Government

The provincial legislature consists of one chamber, the Legislative Assembly, whose 48 members are elected by the people. An election must be held every five years, or at any time the government in power loses a majority in the legislature. The British Crown is represented by a lieutenant governor, appointed by the governor general of Canada for five years. He governs through an executive council whose members are also members of the legislature. The actual executive head of the government and the head of the council is the premier.

The minister of education heads the provincial Department of Education, but the actual administrative head is the deputy minister known as the superintendent of education. He is appointed by the lieutenant governor in council. The elementary and secondary schools are financed by local taxes, with substantial aid from the provincial government. One-half of the cost of school buildings and equipment is paid by the province. In isolated parts of the province, the Department of Education teaches children by correspondence from mimeographed bulletins.

The University of British Columbia, at Vancouver, opened in 1915. Affiliated with it are a junior college in Victoria, and the Anglican Theological College and Union College (United Church), both of which are in Vancouver.

Colorful History

Captain James Cook of the British Royal Navy explored the coast of British Columbia in 1778. His

sailors carried rich furs to China on their return to England, and started the fur trade which was to open this country to the modern world. In the summers of 1792 to 1794 Capt. George Vancouver charted the coast from the Columbia River to Alaska and gave it most of the place names still in use.

The great North West Company was then interested in building fur-trading stations from the interior to the coast. In 1793, one of their explorers, Alexander Mackenzie, completed the first

overland trip to the Pacific coast. He journeyed by way of the Peace and Parsnip rivers to the Fraser, and west down the Bella Coola to its mouth near the present site of Ocean Falls. In 1808 another North West explorer, Simon Fraser, followed the course of the river known to the Indians as the Great River of the West. His adventures through the tremendous canyons of the river which now bears his name are among the great tales of North American exploration and discovery. David Thompson, also of the North West Company, from 1806 to 1809 explored and mapped southern British Columbia. Both Fraser and Thompson established a chain of trading stations.

New Caledonia and Oregon Country

Northern British Columbia by this time was known as New Caledonia. The region to the south and across the present international boundary was "Oregon country." In 1821 the North West Company was absorbed by the Hudson's Bay Company, and the Western Department of New Caledonia and Oregon was put under the command of John McLoughlin, its governor for the next 25 years. He established many new forts, among them Fort Victoria in 1843, on the site of modern Victoria. In 1846 the Oregon Treaty between Great Britain and the United States placed the international boundary along the 49th parallel and gave all Vancouver Island to Great Britain. In 1849 the British government ceded the island to the Hudson's Bay Company and created it a crown colony. Richard Blanshard was appointed the first governor, but he resigned within a year to be followed by James Douglas, who filled that office until 1864.

The discovery of gold on the Thompson River in 1858 brought a flood of immigrants and made it necessary to reorganize the government. At Fort Langley, on the lower Fraser River, on Nov. 19, 1858, the

crown colony of British Columbia was created. New Westminster was founded in 1869 and became capital of the mainland colony the same year. In 1862 a new gold rush attracted many miners to the Cariboo country east of the upper Fraser River. In order to carry supplies and food to the mining communities a road had to be opened up from the coast to the interior. The Cariboo Road from Yale to Barkerville built by the Royal Engineers from 1862 to 1865 aided in the development of the area.

From Crown Colony to Province

In 1866 the colonies of Vancouver Island and British Columbia were united. The capital remained at New Westminster until 1868 when it was moved to

Victoria. On July 20 1871 the colony became a province of the new Dominion of Canada. One of the conditions was that the Dominion government should build a transcontinental railroad to the west coast.

Progressive social legislation has marked British Columbia's recent history. A Labor Relations Board regulates employer-employer relations. All workers contribute to hospital insurance. A sales tax imposed in 1948 supports social security and municipal aid.

In 1961 in the Kamloops-Hatfield area work began on a huge aluminum smelter, the province's greatest single industrial project. In 1953 oil from Alberta reached Vancouver by pipeline. (For Reference Outline and Bibliography see Canada Canadian History.)

HOW an ISLAND NATION Built a GREAT EMPIRE

BRITISH COMMONWEALTH AND EMPIRE The British never sets on the far flung British Commonwealth and Empire. Despite changes that have taken place since World War II it is still the greatest empire of all history. It includes lands on every continent and in every ocean. It covers a quarter of the entire land surface of the earth and contains more than a quarter of all the people. British influence therefore remains an important force in all parts of the world.

This vast empire derives its unity and its strength from the quiet and steady building of democratic processes. Its member countries have been likened to a fleet of ships on the way to the port of full self government. The members of the Commonwealth of Nations have already reached that port. They include—in addition to Great Britain itself—Canada, Australia, New Zealand, Union of South Africa, India, Pakistan, and Ceylon.

The remaining territories are at different stages of the journey and they cannot all travel at the same pace. They include almost 50 different dependencies inhabited by some 60 million people. They stretch around the tropics from British Honduras and the West Indies across Africa to islands in the Pacific. Long experience with colonies has led the British to try to raise the level of dependent peoples to a position where they can share in their own government. For the more backward peoples self government can come about only through gradual improvement in education and living standards.

Beginnings of the British Empire

In the year 1600 England was a small island kingdom with no overseas possessions. Spain and Portugal having taken the lead in opening up the New World and the routes to India, claimed a monopoly of trade with the new lands. Their monopoly was doomed when the seagoing peoples of England, Holland, and France determined to share in the great wealth being brought back from overseas.

The English had a natural liking for naval enterprise and they were especially well located to make the most of their seafaring interest. Soon after Columbus discovered America John Cabot sailed

under the English flag to the shores of North America (1497) (see Cabot). During the reign of Queen Elizabeth I English buccaneers raised terror in the hearts of the Spaniards (see Elizabeth I). The Spaniards complained that Englishmen in the West Indies came and boarded us in the haven's mouth and are become lords and masters of the sea and care for no man.

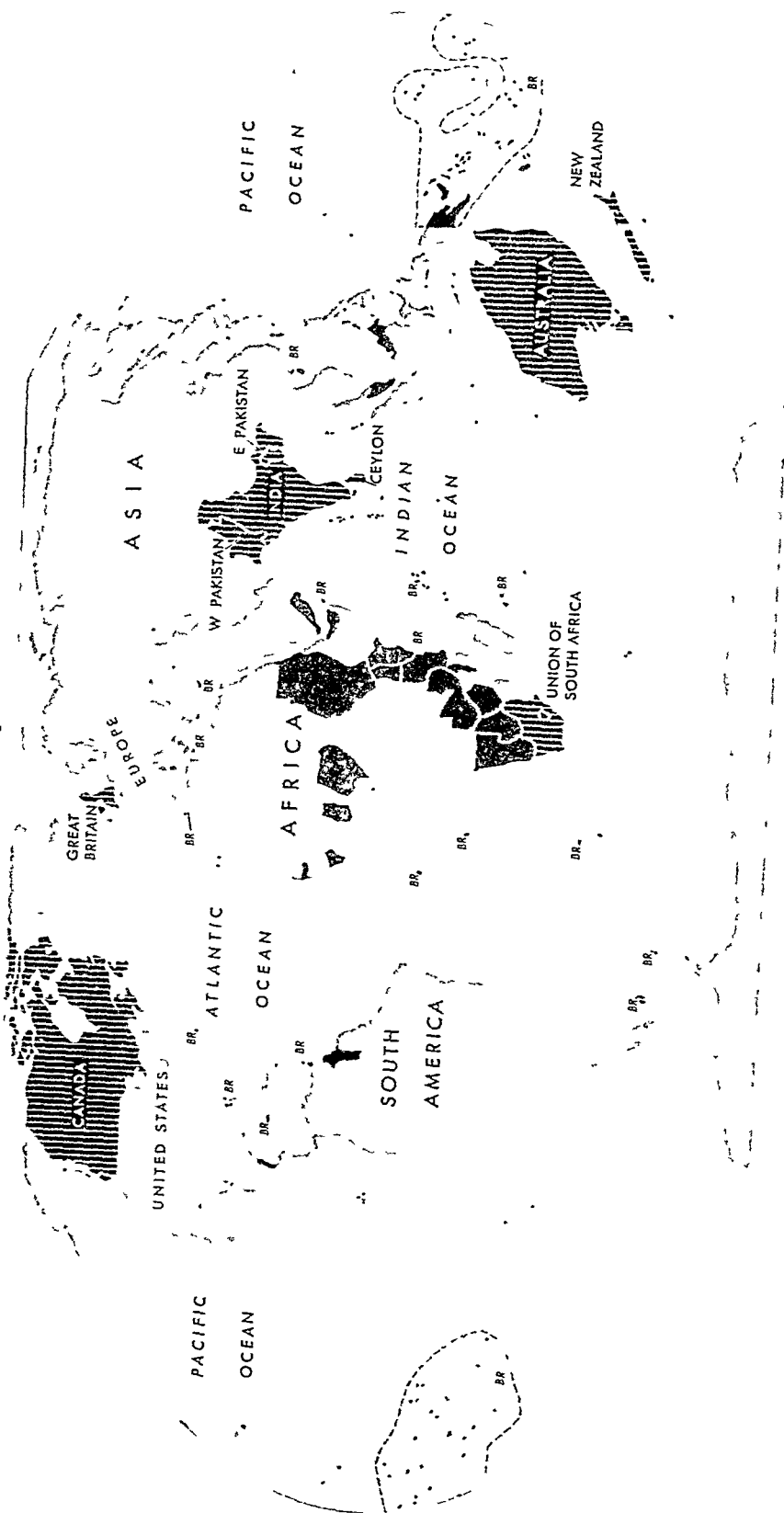
In 1588 Spain decided to put an end to these attacks on its colonies and shipping by English buccaneers. It sent a great Armada to invade England. The English were waiting for them in light swift ships that proved vastly superior to the clumsy Spanish galleons. The Spanish Armada was smashed, the naval power of Spain was broken (see Armada, Spanish).

England was now ready to enter the race for overseas trade and possessions. In 1600 Elizabeth I granted a charter to the British East India Company which was to lay the foundations for British rule in India. In 1610 Henry Hudson opened up Newfoundland to English fishermen and fur traders (see Hudson). James I who succeeded Elizabeth I had plans to colonize North America. The first permanent settlement was Jamestown, Va. founded in 1607. By 1680 English settlers had occupied most of the Atlantic coast of North America. In the same period they answered numerous islands in the West Indies set up trading posts in Africa, founded a settlement in Burma, and secured footholds on the Indian peninsula.

The Dutch and the French had also entered the race for possessions. Wars against the Dutch in the 17th century brought various Dutch holdings into the British Empire, including New Netherland (New York). A long series of wars with France, culminating in the Seven Years War (1756-63), made the British dominant in Canada and India (see Seven Years War).

The Seven Years War marked the climax in the building of what is called the first British Empire. Nine tenths of the empire was in America. The richest part was the 13 colonies strung out along the seaboard. Many of the colonists had left England because they wanted to order their own affairs as they wished. Their free life and their increasing wealth and strength caused them to treat lightly their tie with the mother country. Finally they refused to submit

The British Commonwealth and Empire Today



Great Britain and
Member Nations

Dependencies

The British Commonwealth and Empire extends over all continents and oceans. More than two thirds of its vast area is occupied by member nations of the Commonwealth. These nations are sovereign states. The dependencies include colonies, protectorates, protected states, and trust territories.

any longer to interference in their government and commerce. After a bitter war they won their independence in 1781. This great loss marked the end of Britain's first empire.

Britain Builds a Second Empire

The American Revolution coincided with a momentous revolution in England itself called the Industrial Revolution (see Industrial Revolution). A steam engine was developed and harnessed to new machines that completely changed processes of manufacture, particularly of cloth. Britain became the world's workshop. Manufacturers needed markets for their goods and raw materials for their factories. British shipping therefore grew enormously. The British navy was called upon to make the vast shipping secure and to protect British investments and markets overseas.

Within 25 years after the loss of the American Colonies a second and more extensive British Empire was well under way. Ceylon was added and Australia began to be colonized. Islands and harbors on the great trade routes were acquired as naval bases, provisioning stations or as ports for trade. One of the most important of these was Capetown at the southern tip of Africa on the way to India. This and other coastal holdings expanded into large colonies.

As Britain's population increased the problem of food supply became pressing. Once more people began to move out to the colonies. They chose principally the large areas in the temperate zone that were suitable for settlement by white people—Canada, South Africa, Australia, and New Zealand.

The New Imperialism

Britain's success aroused keen interest on the part of other maritime powers. About 1875 a period called the New Imperialism set in. European nations engaged in a mad scramble for all lands in backward areas not yet taken over. In Britain this imperialistic drive is usually associated with the name of Disraeli, who twice served as prime minister under Queen Victoria. He bought Suez Canal shares to ensure control of the route to India and the Far East and added to Queen Victoria's titles that of Empress of India. The Mediterranean became a lifeline of empire. Lands and islands along the route were added to Britain's already great possessions. By 1914 Britain had many territories in east and west Africa, virtual control of Egypt and the Sudan, most of Malaya, and numerous islands in the south Pacific.

In 1914 the new German empire tried to expand by conquest and drew almost every nation on earth into the first World War. The British lost heavily in men and wealth but emerged from the struggle with more territory than ever. Possessions of Germany and Turkey were distributed to the victors as mandates under the League of Nations. Great Britain obtained the lion's share—Palestine, Iraq, and parts of the German holdings in east and west Africa. The empire had now reached its greatest extent.

Birth of the Commonwealth of Nations

An empire so vast and varied could not all be governed by the same pattern. The lands settled by Eng-

lish speaking peoples quickly developed parliamentary government and the royal governor became a mere figurehead. In 1867 the British Parliament made Canada a self-governing dominion. Australia achieved dominion status in 1901. New Zealand in 1907 and the Union of South Africa in 1909. After the first World War the dominions signed the peace treaties as sovereign states. The Irish Free State became the fifth dominion in 1922.

An Imperial Conference held in 1926 framed the historic definition of the status of Great Britain and the dominions as autonomous communities within the British Empire, equal in status in no way subordinate to one another in any aspect of their domestic or external affairs, but united by a common allegiance to the Crown and freely associated as members of the British Commonwealth of Nations. This principle was embodied in the Statute of Westminster drawn up by the Imperial Conference of 1930 and ratified by the British Parliament in 1931.

Loosening the Bonds of Empire

The first World War was followed by a rise of nationalistic spirit among dependent peoples everywhere. India demanded complete self-rule. The Arab peoples having won their freedom from Turkey resisted control by European powers and protested the establishment of the Jewish National Home in Palestine. Serious disorders swept Egypt. The British agreed in 1930 to end the mandate over the Arab nation of Iraq. In 1935 they granted a new constitution to India. They promised to withdraw their forces from Egypt and they made no objection when the Irish Free State proclaimed itself in 1937 the state of Eire and abolished the office of governor general.

In spite of strains within the empire, Britain entered the second World War a rich imperial power, loyally supported by all the Commonwealth nations except Eire. It ended the war exhausted. In the Middle East and in Asia its authority weakened. The government decided that Britain must withdraw its forces from overseas wherever possible.

Unable to put down the guerrilla warfare in the Jewish National Home, Britain turned the problem over to the United Nations. It granted independence to the small Arab state of Trans-Jordan. In the same year (1947) it stated its intention of relinquishing its control over India by dividing the subcontinent into two dominions, India and Pakistan. In 1948 it gave Burma full independence and granted Ceylon dominion status. In 1949 Eire cut its last ties with the British crown and took the name of the Republic of Ireland.

There were now three non-British nations in the Commonwealth—India, Pakistan, and Ceylon. India in 1949 adopted a constitution proclaiming itself a republic. It desired to remain a member of the Commonwealth (if it were not called British) but as a republic it could not recognize the British king or queen as its sovereign. Once more the British proved their flexibility in meeting changes with in the empire. The governments of the Commonwealth

countries drew up in 1949 a simple declaration stating that India, a republic, would be a full member of the Commonwealth. India would not regard the British king or queen as its sovereign, but it would accept the British Crown as "the symbol of the free association of its independent members." In this declaration the word "British" was dropped from the name of the Commonwealth of Nations.

When Elizabeth II came to the throne, in February 1952, she was proclaimed "head of the Commonwealth" instead of "queen of the British Dominions beyond the seas." Canada, as well as India, had dropped the name "dominion." South Africa was a "union," and Australia was a "commonwealth." Only New Zealand, Pakistan, and Ceylon were still known as dominions, and they were free to change their names if they wished.

Toward Self-Government in the Dependencies

The dependencies stand on various steps in the ladder of political progress. Those on the lowest rung are administered by a British governor alone.

Next come the dependencies where the governor is assisted by a legislature that includes some elected members. On the next step, elected representatives of the people have a voice in all legislative and executive matters. At the top of the ladder, but below the status of a Commonwealth member, are the dependencies that have achieved responsible government.

Most of the older dependencies are *crown colonies*. They have been annexed to the British crown and their people are British subjects. *Protectorates* and *protected states* are as a rule territories more recently acquired. They have not been annexed, and they are administered through native princes or tribal chiefs. *Trust territories* are former League of Nations mandates, now held as trusteeships under the United Nations. (See also English History and articles on the Commonwealth nations. For Reference-Outline, see Great Britain. For a list of territories, see *British Commonwealth and Empire* in the FACT-INDEX at the end of this volume.)

The BRITISH ISLES—Small HOME of GREAT PEOPLES

BRITISH ISLES. The British Isles lie off the northwest coast of continental Europe. They include two main islands, Great Britain and Ireland, and lesser islands off their coasts. The total area of the British Isles is about that of New Mexico.

The larger island, Great Britain, is the home of three peoples—English, Scots, and Welsh. For several centuries the entire group was governed by the British crown. Today the rule is shared by two independent nations. They are the United Kingdom of Great Britain and Northern Ireland and, second, the Republic of Ireland.

The islands lie as far north as Labrador or Hudson Bay in northern Canada. But the climate is oceanic

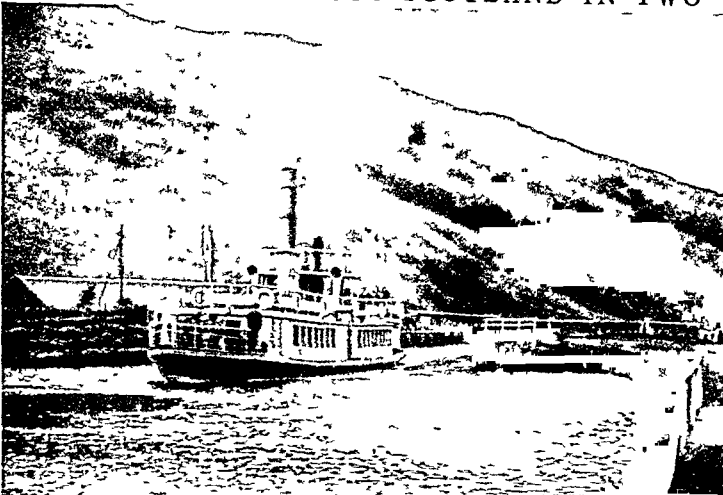
in type. Winters are mild and the summers are long enough to produce crops. The warmth comes from the Gulf Stream. In January the mean temperature ranges around 40°, except in mountainous portions. London has winters as mild as those of Nashville, Tenn. Summer heat is not excessive. Few places have a mean July temperature of more than 60°. Few places in North America are as cool.

The prevailing winds from the ocean to the southwest bring rainfall throughout the year. The rainfall is heaviest on the west coasts, because of low, mountainous rims. Valencia in southwest Ireland has nearly 56 inches a year; Plymouth in southwest England has more than 36. From these extremes the annual rain-

fall drops to about 25 inches on the eastern coast of each island. Thus at its lowest the rainfall is ample for crops and grass; and over much of the islands it produces dense forests if the ground is not kept cultivated. The moisture keeps the skies rather cloudy. About 7/10ths of the sky is covered as a rule. The sun may be obscured for days at a time, even in summer.

This favorable climate has enabled the islands to support a population which has been large for the land area since ancient times. Ample supplies of coal and iron in England and Wales helped the people in the 19th century to lead in developing steam power, factories, and transportation. In this industrial advance they benefited greatly by their situation as islanders living near Europe.

THIS WATERWAY CUTS SCOTLAND IN TWO



A small steamer is carrying tourists through the Caledonian Canal in the Highland region of Scotland. This canal extends from the east coast to the west coast, cutting off northern Scotland. It is used largely by fishing vessels and sightseeing boats.

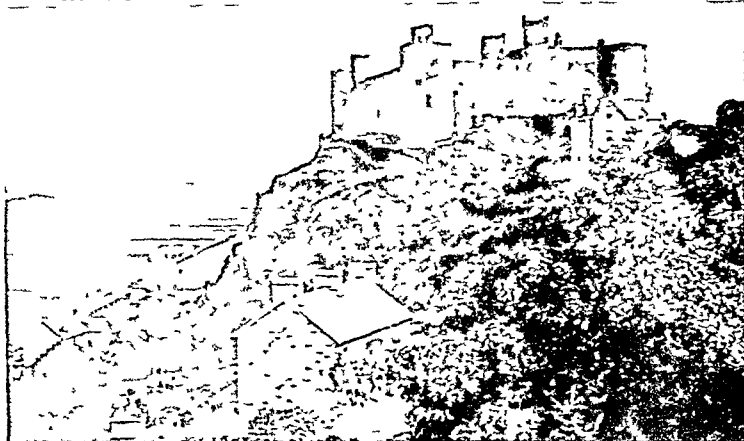
THE BRITISH ISLES

SCALE OF MILES
0 25 50 100 150
1 inch = 99.5 statute miles
HIGH POINT ▲ CANALS — ENGLAND
LIGHTHOUSE ▲ BOUNDARY —



Although less than half as big as Texas the British Isles have almost all the physiographic features found in much larger land areas of the earth. The irregular coast line provides fine natural harbors. Highlands and mountains characterize Scotland and Wales. Ireland is famous for its lakes and England for its rolling parklike countryside.

AN ANCIENT BRITISH STRONGHOLD IN WALES



These are the ruins of Harlech Castle, the scene of the struggle which figures in the Welsh national song, 'Men of Harlech'. During the Wars of the Roses the Welsh tried to hold the castle for the Lancastrian party but were forced to surrender it in 1468.

A glance at the map shows how close Great Britain lies to the mainland of Europe. Long ages ago the British Isles formed part of the continent. This is evident from the similarity in geologic structure of the islands and the near-by continent. For example, the rocky headlands of Scotland resemble the Norwegian coast, the plains of southeast England are like the Dutch and French lands which they face. Further evidence that the islands were part of the continent is the shallowness of the water between them and the mainland. If the Washington Monument (555 feet high) were set down in the Irish Sea, the North Sea, or the English Channel, it would rise high above the water.

(See English History. See also articles on separate countries; for Reference-Outline, see Great Britain)

How the Islands Changed through the Ages

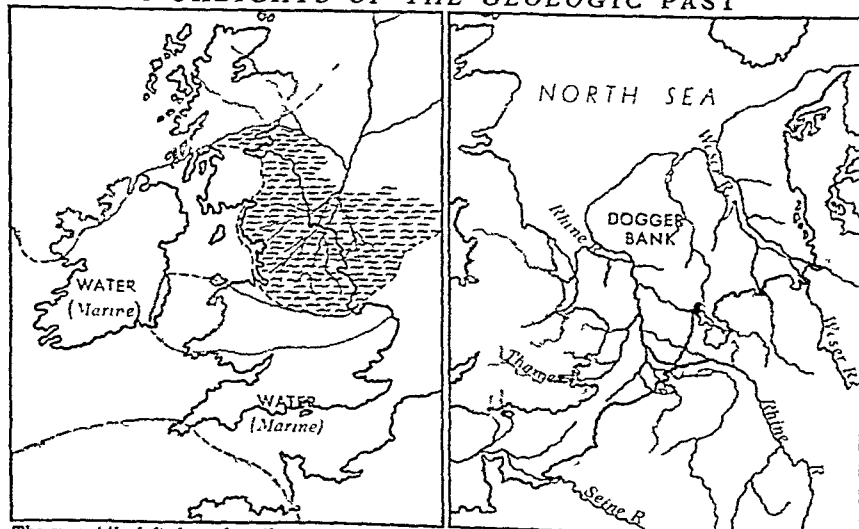
Long ages of geologic upheavals were needed to form the British Isles of today. Through millions of years the region rose and fell. Sometimes it sank beneath the sea, then would be pushed up to form a peninsula of Europe. At times it even formed part of a land bridge to North America. Scientists believed that the early ancestors of the modern horse, camel, and many other animals used this bridge to spread from North America into Europe, Africa, and Asia.

In the earth's earliest ages (Archeozoic and Proterozoic), the region was churned repeatedly by volcanic eruptions.

Mountains formed. Then the entire region sank under the ocean and the Paleozoic era began. Rocks formed in this period have persisted to our time and form the "foundations" of the islands.

The study of these "earth foundations" early in the 19th century helped to develop modern geology. The names of the first three Paleozoic periods — Cambrian, Ordovician, and Silurian — are named from rocks in Wales. The next period, Devonian, is named for rocks found on the Devon coast (see Geology).

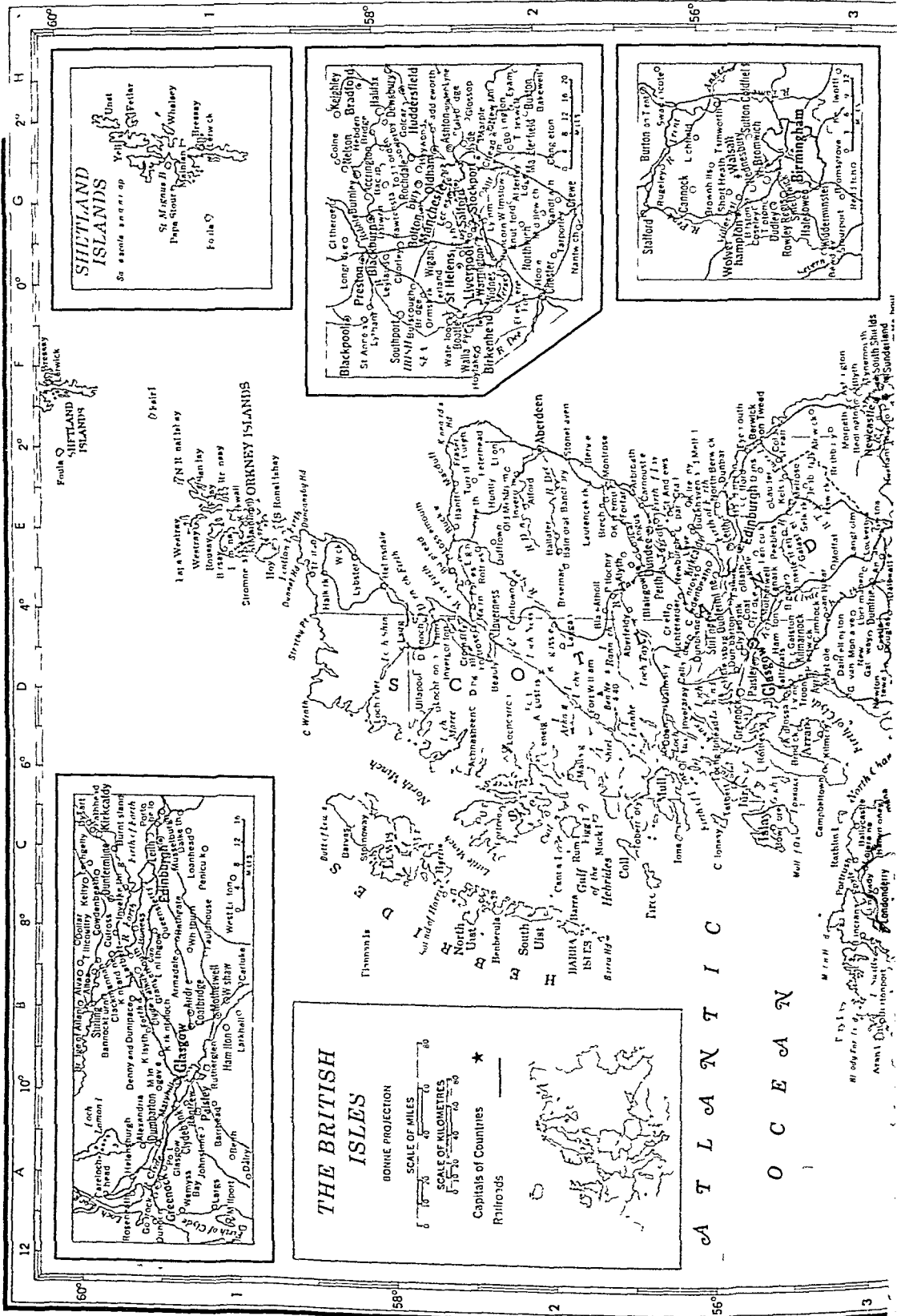
HIGHLIGHTS OF THE GEOLOGIC PAST



The map at the left shows how the region that became the British Isles appeared during the coal-forming (Carboniferous) period. The light areas were occupied by seas; the very dark portions were mountain ranges. Between them a huge delta (broken lines) provided footing for plants which later were buried and became coal. The map at the right shows the land bridge that made Britain a part of the mainland of Europe, at the end of the Ice Age. Because of this bridge, plants, animals, and men could recross the island easily after the ice receded. A portion of this land bridge was formed by Dogger Bank.

BRITISH ISLES

[illegible]



THE BRITISH ISLES

BONNE PROJECTION

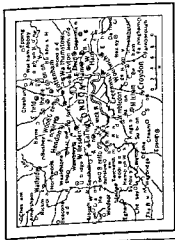
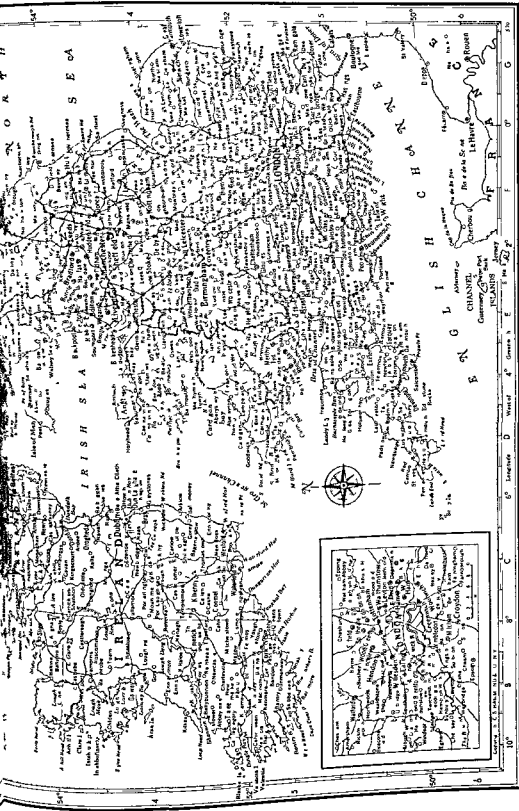
SCALE OF MILES
0 10 20 30

SCALE OF KILOMETRES
0 10 20 30

Capitals of Countries ★

Railroads

A T L A N T I C
O C E A N



Scale 1:100,000
Nautical Miles 1:100,000
Miles 1:100,000

BRITISH ISLES—Continued

[illegible]

In early Paleozoic times a land bridge apparently stretched from Scotland to North America. Then in Silurian times the rocks southeast of the bridge were crumpled into mountain ranges. These stretched from Ireland and Scotland into Scandinavia. During the Carboniferous period rocky debris washed down from these and other mountains formed a giant delta where the great coal beds of central England and deposits of oil shale in Scotland were laid down.

As the Mesozoic era (Age of Reptiles) opened north-west Europe and the British Isles were desert land with some salty lakes. The lakes gave way to seas. In one sea beds of iron ore settled. Then the seas spread turning the region into low scattered isles. Vast beds of chalk were formed.

The Cenozoic (Modern) era began more than 60 million years ago. The scattered isles became larger. Volcanoes erupted in Ireland and Scotland. Great lava flows built a plateau that reached at least as far as Iceland. At last perhaps 15 million years ago the land which had often linked Britain with Greenland sank finally into the ocean. This broke the land bridge between North America and Europe.

Later the Ice Age (Pleistocene) buried the islands. Four successive sheets of glaciers covered all except southernmost England and built up about one-tenth of the present land area of the British Isles. The glaciers finally began to recede from the islands about twenty thousand years ago. At that time England was still a peninsula of Europe. This helped plants, animals, and men to enter the region after the ice receded. The land bridge to Europe remained until 7500 B.C. or later. When it finally sank the North Sea and English Channel joined, breaking the peninsula into the modern British Isles.

BRITTANY FRANCE The ancient province of Brittany lies on a rocky peninsula that juts out into the Atlantic from the northwest coast of France. Here the Bretons have for centuries lived a life apart. They are of Celtic stock and preserve the various customs and remnants of their old Celtic language.

The Breton peasant says the French fears God and the sea and nought else in the universe. Symbols of strong religious faith are the tall crucifixes seen along the waysides. Beside them kneel men in long blouses and wooden shoes or women in lace caps and full-skirted dresses. Near by perhaps is a small church and a cemetery with many crosses over empty graves in memory of daring Breton sailors lost at sea.

The black-haired thick-shouldered Bretons are noted as seamen and Brittany has been called cradle of the French navy. Many sail fishing vessels along the Breton coast. Others sail as far as the banks of Newfoundland across the Atlantic as did their forebears for centuries.

Fertile regions near the coast and river valleys support farming. Although old ways are still followed in many places, some farmers use modern agricultural methods. Market gardens yield a variety of vegetables. Grain flax, hemp, apples and pears are raised. The cool moist summers favor luxuriant grass and the comparatively mild winters permit grazing through most of the year. Cattle raising is of considerable importance. Coal, lead and iron are mined.

The chief ports are Brest, Nantes and St. Nazaire. Brest is also a naval base and St. Nazaire is a great shipbuilding center. Rennes the former capital of the province is an important trade center.

In ancient times this land was the home of the Armorican tribes. It came under Roman control about

51 B.C. Celts from Britain fleeing from the Anglo-Saxon invaders of the 5th and 6th centuries settled in this peninsula and gave it the name Brittany after their island homeland. Through most of the following years Brittany (Bretagne as the French call it) remained an independent duchy until it was incorporated with France in 1532.

Brittany has given many great men to the world. Among them were the medieval scholar and philosopher Abelard, the explorer Jacques Cartier, and the writers Chateaubriand and Ernest Renan.

In the second World War Brittany became a trap for large German forces in August 1944. Led by armored divisions, American troops of the United States Third Army smashed through the St. Lô gap to cut off German defenses in Brittany. This opened the road to Paris.

WASH DAY IN A BRETON VILLAGE



Old ways still persist in many parts of Brittany. Among them is the custom of washing at a common wash place as these women have done at a village stream. The work is tedious but they launder their linens and laces to snowy whiteness.

BRONTË FAMILY. The bleak and lonely moors of Yorkshire in England were the setting for two great novels of the 19th century. These were Charlotte Brontë's 'Jane Eyre' and Emily Brontë's 'Wuthering Heights'. Readers today are still enthralled by their tragic, romantic stories and by the sense of brooding mystery that shrouds the tales. The youngest sister Anne was also a talented novelist, and her books have the same haunting quality.

Their father was Patrick Brontë, a Church of England priest. Irish-born, he had changed his name from the more commonplace Bruntly. After serving in several parishes he moved with his wife, Maria Brantwell Brontë, and their six small children to Haworth in Yorkshire in 1820. Soon after, Mrs Brontë and the two eldest children died, leaving the father to care for the remaining three girls and a boy.

Charlotte was the eldest, born 1816. Emily was born in 1818 and Anne in 1820. Their brother Branwell was born in 1817. Left to themselves, the children wrote and told stories and walked over the desolate moors. They grew up largely self-educated. Branwell showed some talent for drawing. The girls determined to earn money for his art education. They took positions as teachers and governesses, but they were unhappy at being separated and away from Haworth.

To keep the family together, Charlotte planned to keep a school for girls at Haworth. She and Emily went to Brussels to learn foreign languages and school management. In 1844, using a small inheritance from an aunt, they prepared to open classes. Although they advertised, they received no pupils.

The failure of their venture left all the children at home. Branwell was unemployed; temperamental and erratic, he turned to alcohol and opium. Charlotte again sought a way to help the family. She had found some of Emily's poems, written secretly, and realized their merit. She convinced her sisters they should publish a joint book of poems.

In 1846 the girls brought out at their own expense 'Poems by Currer, Ellis, and Acton Bell'. They chose masculine pen names, but retained their own initials. Although critics liked the poems, only two volumes were sold and this venture, like the first, came to nothing.

As children they had all written many stories. Charlotte, as a young girl, alone filled 22 volumes, each with 60 to 100 pages of minute handwriting. Again they turned to writing as a source of income. By 1847,

Charlotte had written 'The Professor'; Emily, 'Wuthering Heights'; and Anne 'Agnes Grey'. After much difficulty Anne and Emily found a publisher, but Charlotte's book was not wanted. (It was not published until 1859.) However, one publisher expressed an interest in seeing more of her work. 'Jane Eyre' was already started, and she hurriedly finished it. It was accepted at once; thus each of the sisters had a book published in 1847.

EMILY AND CHARLOTTE BRONTË



These two sisters wrote enduring novels of tragic love. Their own lives were drab and commonplace by comparison.

'Jane Eyre' was immediately successful; the other two did not fare so well. Critics were hostile to 'Wuthering Heights'. They said it was too wild, too animal-like. But silent, reserved Emily had put all her deep feelings into the book, and gradually it came to be considered one of the finest novels in the English language. Emily lived only a short while after the publication of her book, and Anne died in 1849.

Charlotte published 'Shirley' in 1849, and 'Villette' in 1853. She was acclaimed by London literary society, especially by William Makepeace Thackeray. In 1854 she married her father's curate, Arthur Bell Nicholls. But only a year later, she died of tuberculosis as her sisters had.

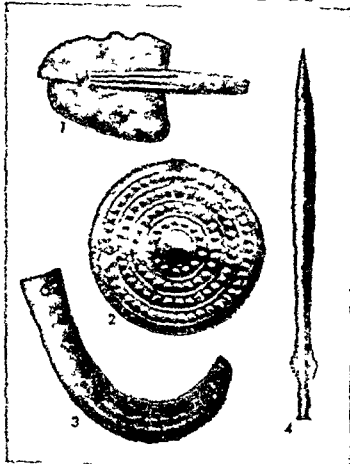
BRONZE. Very early in the history of civilization men had learned to mix copper and tin to make an alloy we call bronze. This mixture was harder than

either copper or tin alone and was used for making swords, axes, arrow tips, as well as other weapons before iron came into use. For this reason the period which followed the Stone Age of man's history has been generally called the Bronze Age. In Europe this period seems to have commenced sometime between 2000 to 1800 B.C.

Bronze is used in modern times to make big bells, for it has a rich tone when set in vibration by a sharp blow. By varying the quantities of tin and copper, the qualities of bronze may be greatly altered. In general the more tin that is used, the harder and more brittle will be the alloy. Bronze is also used in making statuary and for many art and industrial purposes.

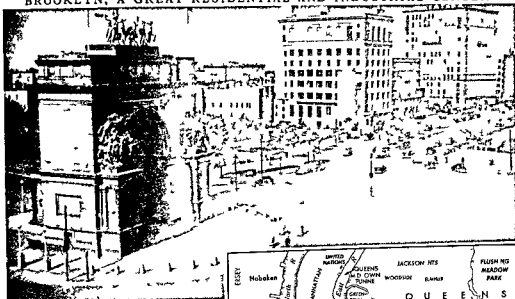
The bearings used in heavy machinery are for the most part

BRONZE AGE RELICS



These bronze articles were fashioned by early Britons in England: 1. A crude razor. 2. A shield dug up from the Thames. 3. A primitive sickle probably used with a wooden handle. 4. A long dagger.

BROOKLYN, A GREAT RESIDENTIAL AND INDUSTRIAL CENTER



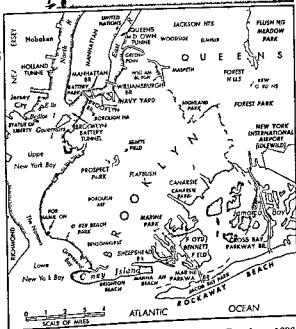
The Soldiers and Sailors Memorial Arch in Grand Army Plaza faces Prospect Park. General W. T. Sherman is at the cornerstone in 1889. Frederick MacMonnies was the sculptor of the three bronze groups. At the right is a map of Brooklyn and its environs.

made of phosphor bronze." A small amount of phosphorus is added as a hardening agent. "Aluminum bronze" can withstand the corrosive action of certain chemicals. In this alloy tin is almost entirely replaced by aluminum. (See also Alloys Brass.)

BROOKLYN N. Y. If Brooklyn were not one of the five boroughs of New York City it would be the third largest city in the United States. It is one of the greatest manufacturing centers in the nation. It is a leader in sugar refining, coffee roasting and the production of razor blades, type machinery and drugs. Brooklyn docks and warehouses handle much of the foreign trade of New York Harbor. And its Navy Yard is one of the country's largest.

Brooklyn occupies the far west end (Kings County) of Long Island across the East River from Manhattan. The two boroughs are connected by three bridges, six subway tubes and the Brooklyn Battery vehicular tunnel, second longest in the world.

Schools of higher learning in Brooklyn include Brooklyn College, Pratt Institute, Long Island University, Cathedral College, Polytechnic Institute, St. Joseph's College for Women, St. Francis College, St. John's University, the law school of the St. Lawrence University and the Long Island College of Medicine. The Brooklyn Institute of Arts and Sciences manages the Brooklyn Museum, the Children's Museum, the first of its kind in the world, the Academy of Music and the Botanic Gardens.



Brooklyn was first settled by the Dutch in 1636. It was named Breuckelen after a town in Holland. On Aug. 27, 1776, Washington was defeated here in the battle of Long Island and the British held the village until the end of the war. At Fort Greene (now Fort Greene Park) were buried 11,000 Americans who died on British prison ships. In 1834 Brooklyn was incorporated as a city. Later Williamsburgh, Flatbush and other suburbs were annexed. In 1898 Brooklyn became a borough of New York City. It has a borough president and controls local improvements such as streets and sewers. (See also New York City.) Population (1930 census) 2,735,175.

BROOMS AND BRUSHES. Most brooms are made from the brushy top of the broomcorn plant. Almost all are now made with machinery. First, the dried "straws" are attached to a handle, and a winding machine wraps them securely with wire at one end. The cone-shaped bundle of straws is put in a vise, flattened, and sewed with heavy twine to hold it in shape. A scraping machine removes most of the broomcorn seeds still attached to the fibers. Finally, trimming and labels are put on the broom. Whisk brooms are made in much the same way. (See also *Broomcorn* in *FACT-INDEX*.)

Nearly all paintbrushes are made of hog bristle or nylon fiber. Bristles are well suited for paintbrushes because they split at the end into a bushy "flag" which holds paint. Even today some of the work of making paintbrushes is done by hand. The curved bristle is first straightened by boiling and heat-drying. After mixing, it is weighed, combed, and inserted in the metal ferrule (holder). Liquid rubber is poured into the spaces between the bristles; after vulcanizing, the rubber holds them securely. Finally the wooden handle is inserted and nailed in.

Fine artists' brushes are made from hair of the red sable and so-called camel's hair (really squirrel hair). Cheap brushes are made from the hair of other animals. The tip of the brush is shaped in a metal cup and then the hairs are cemented into the ferrule.

Scrubbing brushes are usually made of vegetable fibers. The commonest are broomroot (Mexican whisk) and istle (Tampico fiber), grown chiefly in Mexico; littul (or kittool), a woody palm fiber from India and Ceylon; and coir, coconut husk fiber, from Jamaica, India, and Ceylon. In cheaper brushes the tufts

are merely bound with thread, dipped in melted pitch, and twisted into holes bored in the wooden back. Better grades are made by binding the tufts with wires, which are drawn through the holes and woven together.

Hairbrushes and toothbrushes are made of hog bristle or synthetic bristle, such as nylon. The tufts are often cemented directly into the back.

BROWN, JOHN (1800-1859). During the feverish months that led up to the Civil War, many Northerners looked on John Brown as a martyr to the cause of abolishing Negro slavery. Many Southerners regarded him as little more than a common murderer. Today historians look on John Brown as a man of tremendous conviction and sincerity who chose a lawless and futile course in his attempt to accomplish a good end.

John Brown was born May 9, 1800, in Torrington, Conn. His father, a tanner, shoemaker, and farmer, had 16 children by three wives. The family moved to Ohio in 1805, and John early learned to cure hides. He was fond of animals and had squirrels and lambs for pets. He disliked what little schooling he had.

At 15 Brown began doing man's work. He had many trades in his lifetime—woolgrower and wool merchant, farmer, tanner, and surveyor. At 20 he married Dianthe Lusk; they had seven children. She died in 1832. A year later he married Mary Anne Day, they had 13 children. Through the years the Browns lived in Ohio, Pennsylvania, Massachusetts, and New York.

Brown's father had been a staunch abolitionist, and Brown himself was convinced that Negro slavery was a sin against Christianity. He made unflinching abolitionists of all his children and of those who married into the family. He was in his fifties, however,

'TRAGIC PRELUDE': JOHN BROWN IN KANSAS



John Brown's part in bringing on the Civil War is symbolized in this mural in the Kansas State House, painted by John Steuart

Curry. Brown's gaunt, angry figure looms over Civil War soldiers, while behind them are the pioneers who settled the West.

before he finally decided that force was the only way left to banish slavery

In 1854 four of Brown's sons settled at Osawatimie, in the Kansas territory. At once they entered the fight to bring Kansas into the Union as a Free-Soil state. Brown soon followed them and played a leading part in the bloody fights and bitterly contested elections. One son was killed in the fighting. Brown became feared as "Old Osawatimie Brown," a ruthless guerrilla leader against the slaveholders.

When the Kansas question was settled in favor of freedom he formed a mad scheme for making war upon slavery in the South itself. On a rented farm at Hagerstown, Md., he gathered a few men and on the night of Oct. 16, 1859, attacked the little town of Harpers Ferry (see Harpers Ferry). His purpose was to seize the United States arsenal there and procure arms for a slave uprising. He easily mastered the town and the arsenal, but was besieged by the local authorities, who were soon reinforced by United States marines from Washington under Col. Robert E. Lee. Of the 22 men who took part in his raid, ten were killed, seven taken prisoners, and five escaped. Two of the slain men were Brown's own sons, and he himself was wounded.

Brown was tried for "treason, conspiring with slaves and other rebels, and murder in the first degree." He was convicted and was hanged on December 2. His bearing at the trial produced an extraordinary impression of heroic simplicity, purity, and grandeur of character. Within two years after his death Union armies marched to battle singing—

John Brown's body lies a-mouldering in the grave
But his soul goes marching on

BROWNING, ELIZABETH BARRETT (1806-1861) One of the greatest English woman poets was Elizabeth Barrett Barrett Browning. She is chiefly remembered for her immortal love poems "Sonnets from the Portuguese." Her romance and elopement with Robert Browning form the story of Rudolph Besier's well known play, "The Barretts of Wimpole Street."

Elizabeth Barrett was born March 6, 1806 in Durham, England. She was the oldest of 11 children. Educated at home, she learned quickly. She read Greek at eight and at 12 she wrote an epic poem which her father had printed. Until she was 15 she was a lively, healthy child. Then injuries sustained from falling off her pony started her on a life of invalidism that lasted for 25 years.

Confined to her room and usually to her bed, she read and wrote constantly. Her poems brought her fame and a host of admirers. Among them was Robert Browning, six years her junior. He came to see her, convinced her that her illness was largely imaginary, and persuaded her to elope to Italy. They were wedded secretly and were soon on their way. Their married life was quiet, but very happy. They had one son. Elizabeth Barrett Browning died June 30, 1861.

Among her other well known works are "Casa Guidi Windows," "Aurora Leigh" (a novel in verse), and "The Runaway Slave at Pilgrim's Point'.

ROBERT AND ELIZABETH BROWNING



Both these portraits were painted by Field Talfourd in Italy in 1859. The Brownings spent most of their married life there.

BROWNING, ROBERT (1812-1889) Few poets have ever made poetry their career. Poetry is usually an avocation to some profession and is written in leisure time. As a youth in his teens Robert Browning calmly declared that he would make poetry his life's work. With equal calm his parents accepted his decision and encouraged him. Success came slowly, but Browning was convinced of his own genius. So were his parents, who continued to support him for many years. Fairly late in life Browning achieved the fame he so eagerly sought. Much of his work is still enjoyed by readers who like quick dramatic flashes that illuminate human personality.

Browning was born May 7, 1812 in Camberwell, a suburb of London. His father, whose hobby was collecting a huge library of books on unusual subjects, was a clerk in the Bank of England. His mother was well trained in music. Except for a few years of school, Robert Browning received most of his education from his parents and from his own wide reading.

His first important long poem was "Paracelsus" (1835). The public ignored it, but a few critics liked it. The famous actor-manager William Charles Macready asked Browning to write a play for him. Browning wrote "Strafford," which Macready staged in 1837. It had a fair success, but several later ones were failures. In 1840 Browning published another long poem, "Sordello." Of it Tennyson said that the first line in the poem, "Who will may hear Sordello's story told," and the last line "Who would has heard Sordello's story told," were the only two lines he understood and these were both lies. Like many of his other early poems, "Sordello" failed because Browning packed into it a wealth of obscure allusions and too many hints that should have been positive statements.

In 1846 Browning eloped with Elizabeth Barrett (see Browning, Elizabeth Barrett). During the 15 years of their married life Browning devoted himself to his more famous wife. When she died, his own literary star began to rise. At his death on Dec. 12, 1889, he ranked with Tennyson as the leading English poet of his time.

Browning's shorter poems remain the most popular. The dramatic monologues such as "My Last Duchess," are favorites with some readers. Others prefer the

delightful 'Pied Piper of Hamelin', the rollicking 'Cavalier Tunes', and such stirring ballads as 'Hervé Riel', and 'How They Brought the Good News from Ghent to Aix'. Among the poems which carry a deeper message, and which thoughtful people appreciate more and more as they grow older, are 'Pippa Passes', 'The Boy and the Angel', 'Evelyn Hope', 'My Star', 'One Word More', 'The Lost Leader', 'Saul', 'Rabbi Ben Ezra', and 'Prospice'.

Browning's longest and, as many think, his greatest work is 'The Ring and the Book' (1869). This poem, suggested by an old book which he picked up in Florence, Italy, tells the story of a murder from 12 different points of view. It shows Browning's wonderful ability to reveal character from within and to see through the eyes of others. This power of psychological analysis would have made Browning a great dramatist; but he was too much concerned with the inner workings of the mind and too little with outward acts to become a successful playwright. Some of his dramas, however, such as 'The Blot on the 'Scutcheon' and the historical play 'Strafford', are well worth reading.

Among Browning's other important publications are: 'Pauline' (1833); 'Bells and Pomegranates' (1841-46), 'Men and Women' (1855); 'Dramatis Personae' (1864); 'Dramatic Idyls' (1879-80); and 'Asolando' (1889).

BRUCE, ROBERT, KING OF SCOTLAND (1274-1329). A fugitive lay on a bed of straw, heart-sick with discouragement. Idly he watched a spider hanging from its web and trying to swing itself from one beam to another of the wretched cottage roof. Six times the spider tried and failed. "If it tries again and is successful," said the fugitive to himself, "I too will make another attempt." On its seventh attempt the spider was successful.

This fugitive was the Scottish hero Robert Bruce, crowned king of Scotland after Wallace was defeated by the English (*see* Wallace, Sir William). Taking heart from the spider's success, he now won back one stronghold after another. At last on the memorable day of June 24, 1314, the English and Scotch forces met in the great battle of Bannockburn, which was to decide the fate of Scotland.

The great army of Edward II came pouring over the border. Bruce had not half so many men, but what he lacked in numbers he made up in courage and in skill. He chose a strong position. On one side flowed the little stream called the Bannock, with steep rocky banks; on the other rose Stirling Castle. In front were bogs and marshes, and wherever the land was firm, Bruce had pits dug to entrap the enemy's horsemen. The poet Robert Burns makes Bruce address his men in these ringing words:

Scots, wha hae wi' Wallace bled—
Scots, wham Bruce has aften led—
Welcome to your gory bed,
Or to victorie!

The skilled English archers were unsupported by the English cavalry and were forced to retire. When

the armored knights advanced they stumbled into the pits which the Scotch had dug for them, and found themselves helpless before the forest of leveled spears of Bruce's men. Presently from behind the Scottish ranks what appeared to be a fresh army was seen advancing. In reality it was only the servants, drivers, and other camp followers whom Bruce had sent behind a hill, and who now came forward to join the fight. The English were thrown into confusion, and the day closed with one of the bloodiest defeats they had ever suffered. Bruce's throne and Scotland's independence were thenceforth secure.

Bruce proved a wise king as well as a brave warrior, and during his reign (1306-1329) gained the title of "good king Robert." In his later years he longed to go to the Holy Land to fight against the heathen who were again in possession of the Sepulcher of Christ. He was the more anxious to do this because his soul was troubled at the thought that when a young man he had slain a rival before the very altar of God. When he knew that he must die without fulfilling his heart's desire, he called his faithful friend Lord James Douglas to him, and begged him to take his heart after death and carry it to the Holy Land.

When Bruce died, Douglas put the king's heart in a silver casket and started with it for the Holy Land. In Spain he found the Christians hard pressed by the Mohammedans and went to their aid. In the heat of the battle he threw Bruce's heart into the midst of the infidel host, crying: "Go thou before as thou wert wont to do, and Douglas will follow!"

The brave Douglas perished in the battle, but one of his knights recovered Bruce's heart. Deeming that it had done full service against the infidel, he carried it back to Scotland, where it was buried in Melrose Abbey.

BRUGES (*brūzh*), BELGIUM. Quaintest of the many old Flemish towns is Bruges, which lies 55 miles northwest of Brussels and about eight miles from the North Sea. It is intersected and surrounded by many canals, which connect it with Zeebrugge its seaport, with Ostend, and with many other places. Crossing these canals are 50 bridges—all opening in the center to permit the passage of boats—and thus the city gets its name, Bruges, meaning "bridges."

In modern times this Venice of the North has dreamed peacefully of the days long past when it was one of the richest jewels in the crown of its sovereigns, the rich and powerful counts of Flanders—when its woolen trade flourished to such an extent that Philip the Good, in 1430, founded there the order of the Golden Fleece, in compliment to the growth of that industry. Tourists came from far and near to admire the monuments of that great epoch in its history—the beautiful Gothic church of Notre Dame (13th and 14th centuries), with its many art works and its splendid tombs of Charles the Bold and his daughter Mary of Burgundy, the old market hall with its famous chimes of 48 bells, and many other notable edifices. Other Flemish towns may have presented

BRUGES AND ITS GREAT BELL TOWER



Here one of Bruges' placid canals catches a reflection of the famous bell tower atop its Market Hall. Built in three sections in the 13th, 14th and 15th centuries, the tower rises to a crown like top 352 feet above the street. The chime of 48 bells housed in the tower is one of the most musical of Belgium's renowned carillons. The persevering visitor who climbs the 402 steps to the summit can see the quaint, beautiful medieval city spread out below him and follow the course of the canal that leads across the Flemish plain to the North Sea at Zeebrugge, eight miles away.

an equally picturesque appearance, but none was as famous as Bruges. A rival of Venice, it was a world center of commerce in the 14th century. It lost that prestige about 1490 after silt had ruined its harbor on the river Zwyn, and now it has little world trade. Lace and furniture are among the chief manufactures.

Its port Zeebrugge was occupied by the Germans in the first World War, and it was used as a base for submarine raids. In 1918 the British sank concrete-filled ships in the mouth of the port to "bottle up" the submarines. In 1940, when the Germans again occupied Zeebrugge, the British repeated this feat. Population of Bruges (1947 census), 52,748.

BRUSSELS, BELGIUM. The capital and the largest city of Belgium and an important commercial and industrial center, Brussels is famous as well for charm and beauty. It is a center of fashion and art, a city with many modern buildings and other public improvements, yet with a number of quaint and picturesque survivals of the Middle Ages.

About 60 miles from the North Sea, Brussels is almost in the center of Belgium and in the heart of its best farm region. This loamy upland, called the Belgian plain, produces some of the world's richest yields of wheat, oats, rye, and sugar beets.

The central position of Brussels gives it a large trade in these and many other products. Its roads, canals, and railways connect it with the ocean, with other Belgian cities, and with neighboring lands. The city is noted for its manufacture of Brussels lace and fine carpets and for its curtains, furniture, and books. It has sugar refineries, soap factories, foundries, engine shops, and many other industries. Many factories were wrecked during the four years of German occupation in the first World War. Brussels again fell to the Germans in 1940, and roads and railway stations outside the city were heavily bombed. In 1944 the British, aided by Belgium's "white army" of underground fighters, drove out the Germans. The city suffered but small damage during this action.

Like Paris, Brussels is a city of shaded boulevards, open spaces, and beautiful parks. The Grand' Place, or market place, is one of the most interesting public squares in Europe. It is surrounded by many fine old buildings in marked contrast to the otherwise modern character of the city. The largest and most beautiful of these buildings is the Hôtel de Ville, or town hall, built in the Gothic style in the early 15th century. Its belfry, 370 feet high, is crowned with a statue of Saint Michael, the city's patron saint, and the face of the building is richly adorned with statuary. Within its shadow the Count of Egmont and Count Horn, with other gallant patriots who took part in the uprising of the Netherlands against Spanish rule in 1568, were put to death by the Duke of Alva.

This square is in the lower city, now devoted mainly to manufacture and commerce. The upper town contains the offices of state and other public buildings and the mansions of the wealthy. On the hillside is the cathedral of Saint Gudule and Saint

Michael, a noble specimen of medieval architecture dating from the 13th century, with pointed Gothic towers and rich stained-glass windows. The Royal Library, the museums, and art galleries contain priceless treasures, including wonderful examples of Flemish art—by the brothers Van Eyck, Roger van der Weyden, Hans Memling, Rubens, and a host of other artists. Among the public buildings erected in modern times are the king's palace, the house of parliament, and the magnificent Palace of Justice. The University, constituted in 1834, is the most important of the many educational institutions and is notable as almost the only university in Europe founded without the aid of church or state.

Brussels (*Brussel* in Flemish; *Bruxelles* in French, the official language) according to tradition was settled in the 6th century. Its growth was slow until the days of the Burgundian dukes in the 15th century, when it became one of the leading cities of the Netherlands. It was the scene of the first rising of the Netherlands against Spain (1566), but it remained under Spanish rule after the Dutch had made good their independence. It passed to Austria in 1713, after the wars of the Spanish Succession. After being under French rule for a brief period during the French Revolution and the First Empire, Belgium was joined with Holland in the Kingdom of the Netherlands. In 1830 Brussels was the chief center of the revolt which separated Belgium from Holland. The city became the capital of the new kingdom. Population of Brussels (1947 census), 184,838.

BRYAN, WILLIAM JENNINGS (1860-1925). Although he was three times defeated for the presidency of the United States, William Jennings Bryan molded public opinion as few of our presidents have done. For many years he was the leader of the Democratic party, and it was his influence that won the Democratic presidential nomination for Woodrow Wilson in 1912.

Bryan was born and educated in Illinois and practiced law there until 1887, when he moved to Nebraska. There he speedily made a reputation as one of the foremost orators of the day. In 1890 he was elected to Congress, where he was at once placed on the ways and means committee, an honor usually reserved for those who have served in the House for years.

Six years later, at the age of 36, Bryan achieved national fame—he received his first nomination for the presidency when he swept the national Democratic convention off its feet by an impassioned appeal for free and unlimited coinage of silver in the ratio of 16 parts of silver to 1 part of gold. Turning to those who wished to keep gold as the money standard, he exclaimed: "You shall not press down upon the brow of labor this crown of thorns. You shall not crucify mankind upon this cross of gold."

Though Bryan lost the election then and again in 1900 and 1908, he was still regarded as the leader of the party. By his weekly—later monthly—paper called *The Commoner* and by the lectures which he delivered from Chautauqua platforms in all parts of the country, he did much to advance the causes of

prohibition of religion and of morality. In the national convention of 1912 he opposed the reactionaries.

Bryan was named secretary of state by President Wilson. He negotiated treaties with 30 countries representing three fourths of the world's population for investigation of disputes before resorting to war. Because of his opposition to war he resigned from office in June 1915 in protest against the President's firmness concerning the sinking of the *Lusitania*. When World War I came to America however he supported the government.

After the war he moved to Florida and worked to advance moral and religious causes. He died in July 1925 in Dayton, Tenn., where he had been helping prosecute a case involving an anti-evolution law. **BRYANT WILLIAM CULLEN** (1794-1878). In 1811 a 17-year-old boy of Cummington, Mass., was musing one day about the great facts of life and death. His musings naturally fell into metrical form for he had been writing verses before he donned long trousers. Later his father, a country doctor, sent the poem to the editor of the *North American Review*. It was published in 1817 and won instant fame for the writer.

The poem was *Thanatopsis*, the first great poem written by an American, and the writer was William Cullen Bryant, "father of American poets." At the age of 10 this young prodigy had published a poem in a country newspaper. When he was 14 he prepared a collection of poems which was put out in book form and soon ran into a second edition. This was *The Embargo*, a political satire criticizing the policy of President Thomas Jefferson which attracted wide notice.

The publication of *Thanatopsis* marked an epoch in American letters. In the early days of the Republic its writers were slavish imitators of English patterns. *Thanatopsis* was the first genuinely American poem based on independent and original thinking and inspired by our own American landscape.

Bryant had of course read the English poets and had admired some of them intensely. Those to whom he felt most akin were Cowper, Coleridge, and Wordsworth because they too loved nature. Yet he could read their poems without copying their ideas and forms. He wrote *Thanatopsis* in a noble rolling rhythm all his own. He described nature as he found it, austere with a dignity that made even death seem sufficiently beautiful and inevitable, and he scorned the man who feared it.

It is Bryant's poetry that raises his head above the crowd and yet original verse occupied a very small part of his days. He studied law as a boy but did not practice long. For 50 years and more he edited the *New York Evening Post*. America as E. C. Stedman says "called for workers; journalists practical teachers." If after accomplishing their daily tasks they found time to sing a song it thanked them and did little more. When it is remembered that Bryant wrote several books of travel, made many public speeches, translated Homer's *Odyssey*, and flung into blank verse and edited an extensive American history in addition to his newspaper work, it is not astonishing to find that his original verse filled only a few thin volumes.

Among Bryant's most famous poems are "Thanatopsis," "To a Waterfowl," "A Winter Piece," "The Death of the Flowers," "Song of Manion's Men."

The 15th PRESIDENT of the UNITED STATES

BUCHANAN JAMES (1791-1868). The 15th President of the United States was a man who held almost every honor which the American people could give him, and yet he retired from public life under a cloud of deserved rebuke, such as has seldom fallen upon a president of our country. He once referred to himself as an "old public functionary"—which was an apt name for he was in public office almost continuously from the time he was 23 years old until his retirement from the presidency at the age of 70.

Buchanan did not have to fight his way in life by his own efforts as did Lincoln; nor did he, on the other hand, have such able assistance as did John Quincy Adams. His family belonged to the great middle class of American people. They were Scotch-Irish who had settled near Mercersburg, Pa., in the latter part of the 18th century. His father was a merchant as well as a farmer, and in these two callings he made enough wealth to maintain his large family in comfort. His son James gives this account of his own education: "After having received a tolerably good English education, I studied the Latin and Greek languages at a school in Mercersburg. I was sent to Dickinson College in the fall of 1807, where I entered

the junior class. The college was in a wretched condition, and I have often regretted that I had not been sent to some other institution. After graduation Buchanan studied law and was admitted to the bar in 1812. Two years later he began his public career as a member of the Pennsylvania state legislature.

Buchanan and the War of 1812

At that time the country was engaged in its second war with England, a war which Buchanan as a Federalist had opposed before it was declared, but afterwards urged the people to support. He himself volunteered to help defend Baltimore, but he was never called into active service. That he never approved of the war is shown by a speech which he made after peace was declared in 1815, in which he stated that it had been "glorious in the highest degree to the American character, but disgraceful in the extreme to the administration."

Before Buchanan was elected to the legislature, his father was doubtful of the advisability of his entering politics, urging that it was better to be an eminent lawyer than to be part lawyer and part politician. Buchanan disregarded this advice, and he soon became an eminent politician rather than part lawyer.

and part politician. Besides serving in the state legislature, he was a member of both houses of Congress, where he was a strong supporter of Jackson; was minister to Russia, in which capacity he negotiated our first commercial treaty with that country; was minister to England; and was secretary of state under President Polk. In this last position he had a part in the negotiations by which we secured the southern half of the Oregon country, and the vast territory in the southwest from Mexico. He was heartily in favor of the annexation of Texas, and this, together with his share in the Ostend Manifesto, in which he favored the acquisition of Cuba, led to the charge that he was a pro-slavery man.

How He Got to be President

Fortunately for his future political career, he was serving as minister to England at the time of the passage of the Kansas-Nebraska Act, and so was not involved in the quarrels over that bill. This made him an available candidate for the Democratic nomination for the presidency in 1856. Combined with his national reputation as a statesman, it made certain his election over Fremont, the Republican candidate.

Buchanan was nearly 66 at the time of his inauguration—the oldest president, except William Henry Harrison, that the country has had. And at this advanced age he was called upon to face some of the most serious problems which have ever confronted a ruler. It is no wonder if at his age he attempted, in a feeble way, to avert—instead of meeting—the conflict which threatened the country.

Civil war was already raging in Kansas, where slave-state and free-state men strove to secure possession of the state government. Buchanan was impressed by the threats of secession uttered by fire-eating Southerners, and urged Congress to admit Kansas under the Lecompton constitution, which allowed slavery. He declared that Kansas was as much a slave state as was South Carolina or Georgia; but Congress did not agree with him, and consequently Kansas for the time was kept out of the Union.

Thus the rift between the slavery and the no-slavery forces was widened, and the danger of secession became more threatening. The hope that the Kansas dispute might be taken out of politics and settled by judicial decision had proved vain, for

nearly the whole North had denounced and repudiated the decision of the Supreme Court in the Dred Scott case (see Dred Scott Decision).

These questions were serious, and Buchanan's handling of them failed to satisfy the North. But they were insignificant when compared with the crisis of 1860, between the election and the inauguration of Abraham Lincoln, as a Republican President on a platform opposed to slavery extension. President Buchanan's efforts to please both sides were even more

pitiable at this time than before. He declared on the one hand that a state had no right to withdraw from the Union; but in the same message to Congress he said that there was no way to prevent a state from seceding if it wanted to, for the constitution did not give the national government the right to make war on a state. His acts were as contradictory as his words. At first he did nothing to uphold the Union. He had followed for so long the dictates of the Southern leaders that he lacked the courage to oppose them in this critical time. After the resignation of the Southern members of his cabinet, he was induced to send a steamship to Charleston, S.C., with supplies for Major Anderson at Fort Sumter. But the expedition was not allowed to land, and Buchanan made no other attempt to relieve the fort—leaving it to Lincoln, the incoming President, to manage the situation. War supplies were allowed unchecked to fall into the hands of the seceding states. Buchanan blamed the Republicans of the North for the war, because they refused to abide by the Dred Scott Decision and to

enforce the Fugitive Slave Law. Also, he was anxious that it could not be said that war between the states had been started by a Democratic President.

Buchanan's policy was generally condemned in the North, and he was called "the most perfect imbecile that ever held office." It is no wonder that he said to Lincoln on March 4, 1861, "If you are as happy to come into the White House as I am to leave it, this is certainly the happiest day of your life."

This was the end of Buchanan's public career. He retired to his farm near Lancaster, Pa., where he died seven years later. He is the only President who lived and died unmarried. His last years were spent in trying to justify his actions while president, the books embodying his defense bearing the title, 'Mr.



JAMES BUCHANAN

BUCHANAN'S ADMINISTRATION (1857-61)

- Dred Scott decision (1857).
- First Atlantic cable laid (1857).
- Lincoln and Douglas debates (1858).
- Oil discovered in Pennsylvania (1859).
- John Brown's raid on Harper's Ferry (1859).
- Minnesota, Oregon, and Kansas admitted as States (1858, 1859, 1861).
- South Carolina secedes (December, 1860).
- Other Southern States secede and form the Confederacy (1861).

Buchanan's Administration on the Eve of the Rebel lion' Though he upheld Lincoln and claimed the war had been forced on the North by South Carolina and the Secessionists he still maintained that as president he could not have acted other than he did

No one today approves of the charge that Buchanan was 'a traitor to his country' made before he retired from office, nevertheless he is regarded as probably the least successful president the country has ever had

BUCHAREST, RUMANIA Like many other major cities of Europe Bucharest—capital of Rumania—has had many masters It has however kept a lively, almost garish personality all its own

The city spans the Dambovitza River, a navigable tributary of the Danube, some 30 miles south Situated on the fertile Walachian plain it lies on important trade routes to Russia, Bulgaria and Hungary It is one of the great gateways between western Europe and the Near East

The climate of Bucharest is continental Summers are warm, winters are windy and cold

Before the second World War Bucharest was called the little Paris of the Balkans because of its gaiety and luxury Smart shops and crowded open-air cafés lined the principal boulevard, Calea Victoriei (Victory Avenue)

The center of the city is built of stone and brick Spreading out from it are narrow dirty streets lined with one-story peasant huts The principal buildings are the former royal palace the palace of justice the University of Bucharest and the Metropolitan church which is built in the form of a Greek cross The city also has many museums and large parks

A thickly populated agricultural plain surrounds Bucharest Nearby are supplies of salt and of petroleum which is piped from Ploesti about 30 miles north Leading the varied industries are oil refining chemicals textiles and food processing

Bucharest was founded in the 14th century probably on the site of an old Roman fort After being ruled in turn by Turks Russians and Austrians it became the capital of the new Rumania in 1861 During the second World War it was frequently bombed but suffered only minor damage The Russian army entered it in 1944, and the government soon became an absolute Communist dictatorship On Dec 30, 1947, King Michael was ordered to leave the country, and Bucharest became the capital of the Communist Rumanian People's Republic Population (1948 census), 1,041,807.

BUCKEYE AND HORSE CHESTNUT Among the finest of ornamental shade trees are the buckeyes and horse chestnuts With their showy flowers dark luxuriant leaves and graceful pyramid shaped crowns they are a popular planting for streets and parks

THE TREE THAT NICKNAMED OHIO



At the right is the straight trunk of the Ohio buckeye You can recognize these trees by the cluster of five to seven leaflets spread out like the fingers of a hand The smooth brown nuts in their prickly green burs are very bitter The horse chestnut introduced as an ornamental tree from Europe is very similar

The trees native to the United States are the Ohio and the yellow buckeye The Ohio buckeye (*Aesculus glabra*) grows in the central states chiefly in Ohio and in the Mississippi River valley Its abundance gives Ohio its nickname the Buckeye State It is a small tree usually about 30 feet tall The leaves are divided into five to seven finely notched leaflets spread out fingerlike The bark is gray and deeply furrowed The flowers are pale greenish yellow in loose clusters The bruised leaves and twigs have a disagreeable odor The nuts enclosed in a prickly green burr are very bitter The tree probably takes its name from the smooth brown nut with its light-brown spot like the eye of a deer

The yellow buckeye (*Aesculus octandra*) grows in the Ohio River valley and the Appalachian Mountains from southwestern Pennsylvania southward It is very similar to the Ohio buckeye but is somewhat larger There are usually five leaflets The flowers are yellow The nuts are less bitter and are eaten by cattle and other animals, and there is no odor to the tree The wood of both species is used for the manufacture of artificial limbs, furniture boxes, and crates

The horse chestnut (*Aesculus hippocastanum*) is a native of the Balkan Peninsula. It was introduced into the United States as an ornamental tree about the middle of the 18th century and has become naturalized in the northeastern states. It is a larger tree than the buckeyes, reaching a height of 90 feet. It has a beautiful pyramidal crown. The leaflets are larger than those of the buckeyes and usually seven in number. The flowers, in large upright pyramid-shaped clusters, are white with red spots. Another ornamental tree is the red horse chestnut (*Aesculus carnea*), with flesh-colored to scarlet flowers.

BUCKWHEAT. Hot buckwheat cakes are a popular American food for breakfast. The flour with which they are made comes from the seed of the buckwheat plant. Buckwheat is native to central Asia, where it still grows wild. The name comes from a Dutch word *boekweit* or from the German *buckweizen*. Both mean "beech wheat," so-called because the three-sided seed resembles the beech nut.

In Europe buckwheat is used to make a heavy bread, gruel, puddings, cakes, and beer. In the United States the flour is usually mixed with other, lighter flours. Two thirds of the crop, however, is used for livestock and poultry feed. The flowers are rich in nectar, and buckwheat is grown by some bee farmers for the dark-colored, strong-flavored honey it makes.

A new product made from buckwheat is rutin. This is a drug which strengthens the capillaries. It is prescribed in the treatment of diseases characterized by hemorrhage, such as high blood pressure. The rutin is in the leaves and flowers.

About 60 per cent of the buckwheat in the United States comes from Pennsylvania and New York. Ohio, Michigan, Minnesota, and Wisconsin produce most of the remainder. The plant grows on poor soil with little cultivation. It has no serious diseases, but cannot stand extreme heat or strong winds.

The buckwheat plant is known as a weed killer because it grows so rapidly that it crowds out weeds, and its branching growth deprives the weeds of sunlight. It is therefore used to clean up old fields and is plowed under while still green to restore plant food to the soil. It is also used as a cover crop to prevent soil erosion.

Buckwheat grows from a single stem which branches at the leaf axils. The leaves are arrow-shaped. The tiny flowers grow in fluffy white or greenish-yellow clusters. They have a five-parted calyx but no petals. Buckwheat belongs to the family *Polygonaceae*, related to rhubarb and to the common weeds, sorrel and dock. It is not related to the cereals, which are members of the grass family. The scientific name of common buckwheat, grown for flour, is *Fagopyrum esculentum*; of tartary buckwheat, grown for stock feed and rutin, *Fagopyrum tataricum*.

BUDAPEST, HUNGARY. One of the few good places to cross the Danube River, as it flows southward across the Hungarian plain, is below the Vazs gorge. On the rugged hills of the right, or west, bank at this place grew the town of Buda, while on the flat left bank of

the Danube rose Pest. In time, the twin settlements became the modern Budapest, capital of Hungary.

The city dates back to an outpost built by the Romans, which they called Aquincum, "rich waters," for the mineral springs nearby. A little south of Aquincum the Romans set up big ovens on both sides of the Danube to make brick and lime (the Slavic word *pest* means "oven"). After Aquincum fell to the Goths late in the 4th century of our era, the survivors built new homes around the old ovens. As the two settlements grew, Buda on the hills of the right bank built strong fortifications and in 1361 it became the capital of Hungary.

Because they stood at the eastern gateway to central Europe, Buda and Pest were attacked time and again. When Tatar invaders thundered into Hungary in 1241, they destroyed Pest. Buda held out on its fortified hills. In 1526 the Turks pillaged Pest and then occupied Buda (1541) and held it until 1686. The Turks left both cities nearly in ruins.

The natural advantages of their location were so great that the twin cities rose again from disaster. Their position on the Danube made them the natural gathering place for people bringing farm and range products from Hungary's rich plain and minerals and timber from the northern highlands. In 1872 the twin cities were united into a single community.

Despite their union, each continued to develop along its early lines. Rugged hills made the expansion of Buda difficult, and its population remained relatively small; but it retained the administrative and cultural leadership of Hungary. Its government buildings, royal palace, citadel (the Vár), theaters, concert halls, promenades, and open-air restaurants made Buda one of the most beautiful cities in Europe.

Pest thrived as a financial and commercial center. From its busy water front, it spread far out on the sandy plain. Huge flour mills rose in the industrial district to grind Hungary's wealth of wheat. Other industrial plants included some of the largest electrical works in Europe, shipyards, and factories for making chemicals, textiles, and shoes. In Pest too were the University of Hungary and a large technological institute. The University notably fostered the language and literature of the Magyars. On Margaret Island, between Buda and Pest, rose clusters of hotels, health resorts, and amusement centers.

Hungary became an ally of Germany during the second World War and Budapest fell into German control. The Allies bombed it heavily as an armament center. In 1945 the Russians captured it after a savage battle of 50 days had nearly destroyed the city. It was rebuilt and soon regained its commercial importance. Population (1949 census, preliminary), 1,058,288. **BUDDHA** (about 563-483 B.C.). More than 500 years before Christ was born—and at about the same time that Confucius was teaching the Chinese how to lead the good life—a Hindu prince named Siddhartha Gotama (or Gautama) became famed in India for his holiness and love for all creatures. He was called "the Buddha," meaning "the Enlightened One." Many

BUDDHA, THE ENLIGHTENED



This calm and smiling Buddha is the work of a 4th-century Indian artist. Influenced by classic Greek sculpture he created this distinctly oriental image

persons believed in his teachings while he lived. After his death temples were built in his honor and his religion spread through a great part of Asia. Today some 150 million people profess the Buddhist faith. Monks in saffron yellow robes and the slender many storied pagodas are the outward marks of Buddha land. A gentle kindly people who try to observe his rules of universal love are among the inner signs.

A Young Prince Is Born

The Buddha was born to a noble family of the ruling class in northern India just below the present Nepal border, in sight of the lofty Himalayas. He was raised in luxury by an adoring father who sought to protect him from the sight and knowledge of evil. He married early and had a son while he was still a youth. One day according to legend he rode forth from the palace in his chariot. By the roadside he saw an aged man, a sick man and a corpse on a litter. Shocked by his first experience with old age, sickness and death the prince lost all joy in living.

One night he left his sleeping wife and infant son and rode away into the forest. He renounced the world and through all sorts of penances even to the point of almost starving to death he sought to gain insight into life's meanings. As he meditated in solitude under the Bo tree which Buddhists call the tree of wisdom, he experienced a spiritual awakening known as the enlightenment. He devoted the rest of his many years until his death at the age of 80 to wandering through India teaching the people. Like Jesus he gathered about him a few devoted disciples who shared with him the task of spreading his teachings.

A vast literature in the ancient language Pali and also in Sanskrit records his sermons and his conversations with his disciples. No single canon of scriptures is accepted by all branches of Buddhism.

Buddha did not claim to be of divine origin nor did he claim revelation from above. He meditated a

great deal but he prayed to no Higher Being. In Buddhism there is no beginning and no end, no Creation and no Heaven. Buddha accepted many of the beliefs of Hinduism the religion of his time (see Hinduism).

Fundamental is the belief in *transmigration*—the return of the soul in other forms of life. Carried over into each life is one's *karma*, a mysterious moral force which survives death. It is defined as "the whole ethical consequence of one's actions" and establishes one's lot in the future existence. Evildoers return as animals or unfortunate humans. The good return in progressively higher and more fortunate conditions of life until at last they are worthy of *Nirvana*. This is a blissful state of emptiness in which one is freed of all desire. Once one has entered *Nirvana* he need never be born into the world to suffer again.

The Four Noble Truths

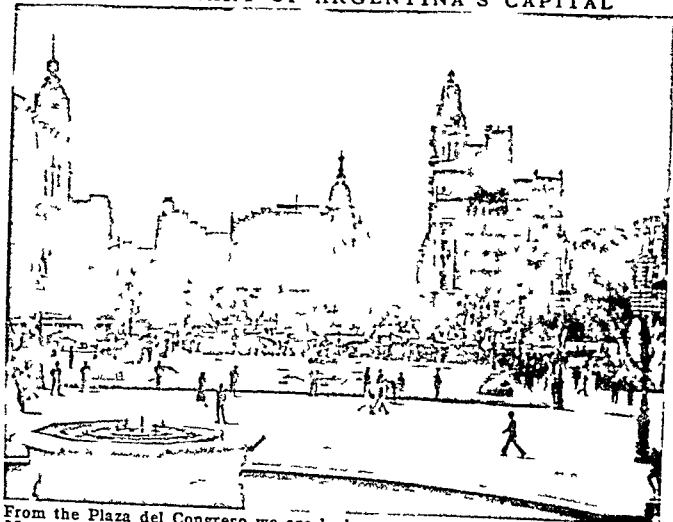
In the Sermon at Benares which Buddhists hold in the same reverence as Christians do the Sermon on the Mount, Buddha set forth his beliefs. There is a middle way of life between the extremes of self-indulgence and self-mortification. To pursue the middle way one must recognize the "Four Noble Truths." They may be briefly stated as follows: Human life is an existence of suffering. Human suffering is caused by desire for things which cannot really satisfy the spirit. Suffering can be ended and man set free by renouncing these desires which are rooted in ignorance. Finally man can free himself of desire by following the "Noble Eightfold Path" of right views, right aspirations, right speech, right behavior, right mode of livelihood, right efforts, right thoughts and right contemplation.

In everyday life the eightfold path requires that the individual do no harm to any creature. Expressly forbidden are theft, falsehood, unchastity, strong drink and the taking of life. These laws remind Christians of the Ten Commandments. As a rule of conduct Buddha taught the Golden Rule. He believed that all that we are is the result of what we have thought, which is reminiscent of the Biblical statement: "as a man thinketh in his heart so is he."

In its spread over Asia, Buddhism's greatest strength appeared to lie in its adaptability to local beliefs. In India itself it was largely absorbed into Hinduism. But in China and Japan it exists side by side with Taoism and Shintoism. In Tibet it was greatly altered into a faith called Lamaism. It is worshipped in its purest form in Burma and Ceylon.

BUENOS AIRES (*buġ nās tr' ez*) **ARGENTINA**. If you follow the golden highways of the world's commerce, you will find yourself before long sailing up the wide mouth of the Rio de la Plata from the east coast of South America and docking 165 miles from the sea in the harbor of Buenos Aires, the capital of the Republic of Argentina and one of the wonder cities of the world. Around you will be moored or anchored scores of steamers flying the flags of all nations. Spread out on the south bank of the river, more than

IN THE HEART OF ARGENTINA'S CAPITAL

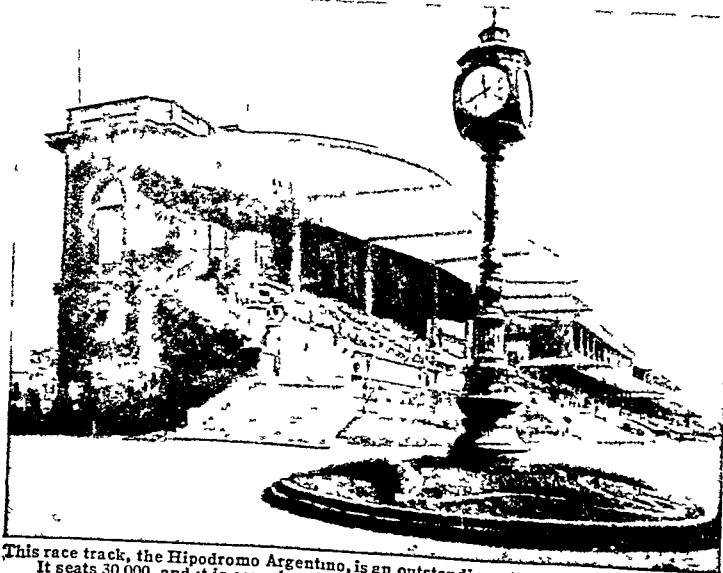


From the Plaza del Congreso we are looking eastward down the Avenida de Mayo, the "gay white way" of Buenos Aires. This photograph was made from the base of the Liberty Memorial which stands in front of the House of Congress.

30 miles broad at this point, you will see a great modern metropolis, 16 miles long and 12 miles wide, where a few decades ago there was only an old-fashioned unpaved cattle town.

Buenos Aires today is the largest city in the southern hemisphere, and the third largest on the American continents, ranking ahead of Philadelphia. The city is imbued with the enterprising commercial spirit of the New World and wealth and progress are the results. The vast harbor system, which was constructed at a cost of \$50,000,000, has opened the shallow river channels to the largest ships. Huge warehouses line the 15 miles of wharves, including the "Central

CENTER OF SPORT AND FASHION



This race track, the Hipodromo Argentino, is an outstanding attraction in Buenos Aires. It seats 30,000, and it is considered the most beautiful race course in the world.

Fruit Market," the largest warehouse in the world, occupying an area equal to nine New York City blocks. More foreign goods pass through these storehouses than through any other American gateway outside of New York City.

Beyond the wharves lies the city in all the magnificence of imposing new buildings, broad streets, beautiful parks, and handsome squares. The thoroughfares are alive with automobiles, street-cars, trucks, and all the signs of thriving industry. On the sidewalks before the glittering shop windows every language of the globe may be heard. On the news stands, besides papers in Spanish, will be found publications in English, French, Italian, German, Scandinavian, Yiddish, and Arabic.

Of the city's newspapers, *La Nación* and *La Prensa*, the largest, attained world recognition. *La Prensa* offered social services, a library, free evening schools in commerce and music, free medical and legal aid, and a free chemical laboratory. In 1951 the dictatorial government of President Juan Perón closed this independent newspaper and expropriated its properties.

A modern, five-line subway system serves *porteños*, as the people are called. Their water system and sewers, built at a cost of \$45,000,000, are unexcelled; with other sanitary measures they have rid the city completely of its former cholera and yellow fever.

Buenos Aires has many fine schools and technical colleges, and an excellent university. The people of all classes are great lovers of drama and of music,

and each year some of the greatest singers and actors in the world appear in the numerous and gorgeous theaters. The great Plaza de Mayo, near the water front, is the center of the official life of the city. Here are the Casa Rosada (the Pink House), the official residence of the president, the 19th-century cathedral of classical design, and the National Bank of Argentina. From here the broad, tree-lined Avenida de Mayo stretches about a mile to the Plaza del Congreso, where stands the immense House of Congress.

Buenos Aires draws its wealth from the vast cattle and farming lands of Argentina, and it is the centre of the country's extensive network of railways. The city contains almost one-fifth of the national population. The mayor is appointed by the president. The fact that politics and business are centered here has at-

tracted foreign immigration and capital to the city and it promises to maintain Buenos Aires as one of the most important trade centers of the world. Population (1947 census) 2 982 580

BUFFALO The true buffaloes—which must be carefully distinguished from the American buffalo or bison—are natives of India and most parts of Africa except the north. The Indian buffalo is still to be found in wild herds though as a rule it is domesticated. This animal is larger and more powerful than the ox and because of its great strength and its ability to labor in water-covered ground its services are very highly valued. It is a most interesting sight to see this huge creature at work in the rice fields with its head held low and its nose thrust forward steadily pulling a cultivator through the flooded mud. The water buffalo or carabao of the Philippines is a domesticated variety of this species. The abundant milk of the cow is made into butter especially the semisolid butter of India.

The Cape buffalo of south and central Africa is of the same powerful bulk as the Indian buffalo. Instead of long horns curving outward and backward the Cape buffalo has short flat horns so thickened at the base as to form a helmetlike mass which makes the forehead almost invulnerable. The ear is larger and the head shorter than that of the Asiatic animal. Both beasts have ashy black sparsely haired hides which are valued for their toughness. The fierce cunning Cape buffalo has never been domesticated and is considered one of the most dangerous jungle beasts. Like its Indian cousin it frequents reedy swamps in herds to feed on water plants. The buffalo birds or cattle herons pick ticks from its hide and warn it of danger (For picture see Africa).

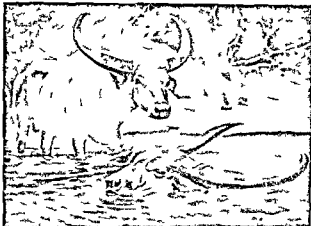
A dwarf red buffalo frequents the Congo region. A sturdy dwarf buffalo of Mindanao P. I. is the taruman. The anoa of Celebes a little over three feet high is the smallest of wild cattle. (See also B. son.)

Buffaloes belong to the family *Bovidae* of the order *Artiodactyla*. The scientific name of the Indian buffalo is *Bubalis bubalis* of a larger Indian form *Bubalis ornata* of the Cape buffalo *Bubalis capensis* of the Congo buffalo *Bubalis nanus* of the anoa *Anoa depressicornis*.

BUFFALO N Y The Queen City of the Lakes is the second largest city in New York State and the 15th largest in the United States. It is situated at the inlet of Lake Erie into the Niagara River at the eastern end of the lake. The city has about 37 miles of water frontage. It is 24 miles south of Niagara Falls.

The city's position on the Great Lakes together with other transportation advantages gives Buffalo its rank as a world port in the volume and variety

THIS ANIMAL HAS A TEMPER



The wild Indian or water buffalo seen here peacefully bathing has a very bad temper. A bull buffalo which may reach a height of six feet at the shoulder can sometimes overcome a tiger and may even attack men. The water buffalo can be tamed however and in the Far East it is a very useful farm animal.

of its shipping. The Welland Ship Canal 20 miles west gives Buffalo a water route to the St. Lawrence River and the New York State Barge Canal (Erie Canal) makes a continuous waterway from Buffalo to the Hudson River. The harbor at the mouth of the Buffalo River protected by an immense breakwater is one of the best on the Great Lakes and a new harbor has also been made by building a breakwater in the Niagara River. Two bridges span the river connecting Buffalo with the Canadian village of Fort Erie in Ontario. The 4½ million-dollar bridge to Fort Erie completed in 1927 is known as the Peace Bridge to commemorate the hundred years of peace between Canada and the United States.

As a center of railroad transportation Buffalo is second only to Chicago. Since it is about the same distance from New York Philadelphia Baltimore and Chicago it handles an enormous amount of freight in shipment and transshipment especially grain lumber coal and ore. Railroad transportation is its largest single industry.

Nearness to raw materials and to electric power from Niagara Falls makes Buffalo a city of diversified manufactures. The key industries are iron and steel rubber lumber grain and chemicals. Other important products are soap linseed oil dyes and other coal tar products leather clothing cereals furniture railroad cars airplanes parachutes and automobiles from assembly plants. It is the first flour milling city in the United States and its water-front grain elevators hold millions of bushels of wheat.

The city has beautiful parks and drives. Overlooking the lake at the mouth of the Niagara River is 'The Front' a park situated on a bold bluff 60 feet high. A beautiful marble shaft in Niagara Square honors the memory of President McKinley who was shot in Buffalo while attending the Pan American Exposition in 1901.

Buffalo is the home of State Teachers College, Canisius College, D'Youville College, and the University of Buffalo, founded in 1846 with Millard Fillmore as chancellor. Notable too are the Buffalo Museum of Science; Grosvenor Library, one of the nation's largest reference libraries; and Albright Art Gallery, famed for its modern sculpture collection.

As a gateway to the west, Buffalo attracted settlers as early as 1803-4. In 1813 the little trade center was burned by the British, but was incorporated as a village in 1816 and as a city in 1832. The choice of Buffalo as terminus of the Erie Canal and later as a key site in railway transportation brought rapid growth. Buffalo was the home of two presidents, Millard Fillmore and Grover Cleveland. Population (1950 census), 580,132.

BUFFALO BILL (WILLIAM FREDERICK CODY) (1846-1917). Most American boys have heard of Buffalo Bill, even though many years have passed since he rode the Western plains. He ranks with Boone, Crockett, Carson, Bridger, and Wild Bill Hickok for his feats as a frontiersman. In his later years, he was equally famous as a showman. His Wild West Show was one of the most popular attractions of his day.

Buffalo Bill was born in Scott County, Iowa. In 1854 his family moved to Kansas, near Fort Leavenworth. There his father Isaac died, in 1857, when the boy was only 11. Young Cody had to work; so he got a job riding as messenger with supply trains. At the age of 13, he entered school. This was his first serious schooling, but it lasted only two and one-half months. Cody called it "the longest period of schooling that I ever received at any one time of my life." At 14, he became a rider for the Pony Express (*see Express*).

After the Civil War broke out, Cody went on forays against Confederates and did some scouting against Indians. Early in 1864 he enlisted in the Seventh Kansas Cavalry of the Union Army. One of his duties was scouting. In 1867-68 he furnished fresh buffalo meat to the laborers laying the track of the Kansas Pacific Railroad. Riding his horse Brigham, he killed (by his own count) 4,280 buffalo within 17 months. Thus he gained his nickname Buffalo Bill. (*See also Far West*). He then served for three years as chief of scouts of the Fifth Cavalry. In 1872, as a scout for the Third Cavalry, he was awarded the Congressional Medal of Honor.

From 1872 to 1883 Cody was an actor in melodramas. He interrupted his stage career to guide cavalry in the Big Horn country in 1874 and to take part in the Sioux War in 1876. In that war he is said to have slain the Cheyenne chief, Yellow Hand, in single combat at Warbonnet Creek in Nebraska.

In 1883 Cody started his famous Wild West Show (*see Circus*). The show grew steadily, traveled widely in America and Europe, and played for 30 years.

Cody made millions as a showman, but lost nearly all of it through unwise investments. He had, however, become one of America's chief landowners. In 1877 he had purchased in partnership with Maj. Frank

North a ranch in Nebraska, and in 1895 he formed the Shoshone Land and Irrigation Company that held 400,000 acres in northwestern Wyoming. Here, on the Shoshone River, he founded the town of Cody.

In 1917, less than four years after losing his Wild West Show to creditors, Buffalo Bill died in Denver. On the peak of Lookout Mountain, 20 miles from Denver, his body rests in a vault hewn out of the rock.

BUGLE. One of the oldest of musical instruments, the bugle is now chiefly devoted to military use for sounding signals and orders and for playing marches in a drum and bugle corps. The army or navy of every nation has its own system of bugle calls which soldiers and sailors must learn to recognize. The music of three United States Army calls follows:



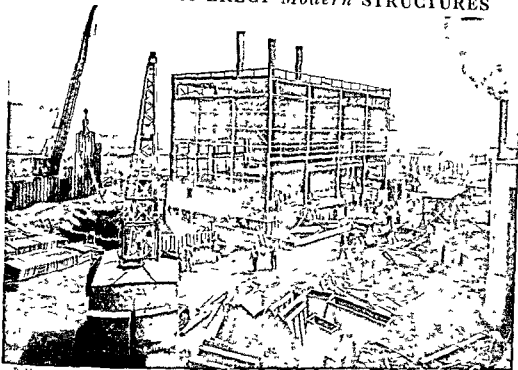
The infantry bugle is usually keyed in B flat; the smaller cavalry bugle (called "trumpet" by cavalrymen) is keyed in C. The artillery trumpet is still smaller and higher pitched (E flat), and has a conical mouth. To blow a bugle well requires much practice both for technique and to toughen the lips so that they can withstand the sharp vibrations.

BUILDING AND LOAN ASSOCIATION. When a person with a little money wishes to buy or build a house he may obtain the remainder of the money he needs from a building and loan association. Mutual corporations of this kind are also known as savings and loan associations, homestead associations, or cooperative banks. They provide capital for building and furnish a means for investing savings.

Loans are made from the sums invested. Borrowers are required to give the association a first mortgage on their property. They repay the loans gradually in monthly payments which also take care of interest on loans and usually of taxes on the property. Investors may make regular small payments or invest lump sums. Dividends are paid or compounded semiannually from the association's earnings.

Home-financing institutions operate under state or federal charters. The Federal Savings and Loan Insurance Corporation was created by the government to insure investments up to \$10,000 in all federal building and loan associations and such state-chartered associations as apply for insurance and are approved. Building and loan associations are also reinforced through the Federal Home Loan Bank System, a part of the Housing and Home Finance Agency. The first building and loan association in the United States was organized in Frankford, Pa., in 1831. (*See also Housing.*)

How BUILDERS ERECT Modern STRUCTURES



Buildings under construction present a fascinating mass of operations. These industrial structures erected by the Austin Company are in various stages of completion. The boiler house in the center is about half finished. At left pile drivers are pounding in metal supports for another structure. In the foreground are heating and ventilating sections awaiting installation.

BUILDING CONSTRUCTION Everywhere around the civilized world people must have buildings in which to live, work, or store their goods. To serve these needs, and many others, builders erect a wide variety of structures ranging from snug barns to tall skyscrapers.

Every building must provide shelter against the elements, and whenever necessary it must provide heat, electricity, and plumbing facilities. And if the building is to serve its purpose well, it must be constructed of suitable materials, present an attractive appearance, and make efficient use of space.

The pyramids of ancient Egypt, the cathedrals of medieval Europe, and the gorgeous palaces of the Renaissance all testify to the builder's skill in past ages. But these edifices were constructed at an immense cost of human strength and even lives. Many of today's buildings achieve the same standards of beauty. Moreover, they are far more useful and comfortable. And they are built by methods that replace human brawn with far greater mechanical strength.

Thus modern buildings are the product of advanced principles of design, highly mechanized construction methods, and materials—especially structural steel, concrete, plate glass, and treated wood—suited to these designs and methods. Few of these advances came until the last part of the 1800's. Since then,

they have been widely applied, especially in building lofty skyscrapers in large cities.

How Skyscrapers Are Built

As cities grew, building lots in central locations became immensely valuable due to the great demand for office and store space. With old construction methods, walls for tall buildings supported the entire weight. These had to be so thick at the base that there was little floor space left. The invention of steel-skeleton construction overcame this difficulty and made it possible to rear towering structures to heights of more than 1,000 feet.

In steel skeleton building, a framework of steel carries the whole weight of the building walls and all. This framework has a boxlike rigidity. The floor beams are riveted to columns, and the beams of each story jut out beyond the columns and bear the weight of that story. The walls are then of uniform thickness throughout. Credit for this invention has been given to William LeBaron Jenney, who planned the Home Insurance Building in Chicago (1884), but the matter is still in dispute.

Work can be started at any story where the framework is completed. While structural ironworkers are riveting the framework 40 or 60 stories high, other workers below are installing walls, floors, and windows. The frame must be strong enough to sustain the

enormous weight of the whole completed structure, and be braced to withstand the wind pressure. The completed structure must also be elastic enough to resist possible side thrusts, such as might come from slight earthquakes or from vibrations caused by machinery within or the passage of trains near by.

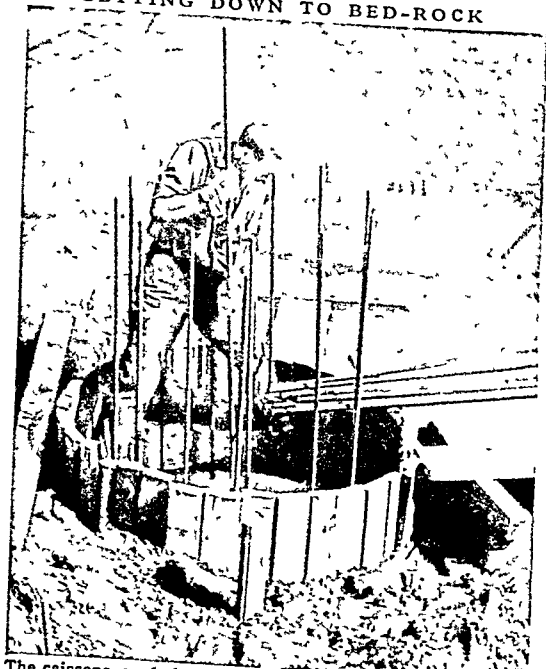
The most important parts of the framework are the columns. These are made of very tough steel which will not break under sudden strains as ordinary steel does. They usually consist of long plates with one or more flanges attached at right angles by riveted angle-plates. They come as a rule in two- or three-story lengths, all ready to be riveted together as soon as they are hoisted into position by great derricks and cranes. All the steel is carefully painted several times to protect it from rust.

Sinking the Foundations

The firmest foundations are pillars of concrete that go clear down to bed-rock. The excavation is made under or in pneumatic caissons under great air pressure, and the caissons are filled with reinforced concrete. Many of the buildings of Chicago, where the soil is soft, rest on a forest of wooden piles driven deep down, or a "platform" foundation. For a platform foundation, an excavation is made covering the entire area of the building. In this is built a bed of iron rails or timbers and cement to support the columns. The general practise today, however, is always to sink caissons to bed-rock.

For the walls, cornices, and decorative features stone, brick, concrete, terra cotta, or tile are used,

GETTING DOWN TO BED-ROCK



The caissons, sunk down to bed-rock, are filled with reinforced concrete, each hardening into a stony pillar.

"HIGH STEEL" MEN AT WORK



The riveting crews who "pin" together the huge framework of skyscrapers are the heroes of many a tale of daring.

singly or in combination. Every effort is made to employ fire-proof materials to the greatest practicable extent. The floors are usually constructed of hollow tile arches placed between the floor beams, covered with concrete and surfaced with any desired flooring. For the inside partitions fire-proof hollow tile is often used; a netting of wire fastened to an iron framework at times takes the place of laths. The roofs are often made of "actinolite." This consists of a number of thicknesses of heavy felt imbedded upon a smooth portland cement surface and covered with a roofing cement, on which vitrified tiles are laid.

The Use of Terra Cotta

Architectural terra cotta has been developed to a very large extent in the past few years. This is a hard clay product, nearly fireproof; and it is largely used for interior walls as well as the superstructure. It can be glazed and made in almost any color and shape the architect and builder may desire.

The steel parts are inclosed in non-combustible material, for if one column of steel is twisted out of shape the whole building is in danger. Terra cotta is generally used for this purpose, because of its insulating qualities and light weight. Concrete is also an excellent fire-resisting material, although not proof against intense continued heat.

The recent development in the use of concrete is of no less importance than the invention of the steel-skeleton method. Up to certain heights, reinforced concrete is almost as strong and durable as steel, and it has the added advantage of being far cheaper. By reinforced concrete is meant concrete in which steel rods are imbedded to give added strength to resist

a side pressure or a pull. Since concrete shrinks and expands slightly with extreme changes in temperature expansion joints to correct this tendency are provided by putting in double columns and double beams separating the entire structure into units.

From the mixing machine the wet concrete is poured into forms of wood or steel where it is allowed to harden. If no great side stress is to be resisted no steel reinforcement is necessary and the concrete is called *massive concrete*. As a rule the supporting frame is left on for two to four weeks to give the concrete time to harden. (See also Brick and Tile, Cement Concrete, Iron and Steel.)

The Problem of Building Suitable Residences

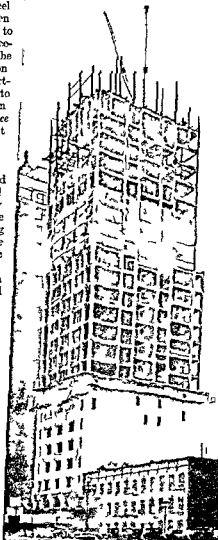
An equally important field of construction is the building of residences. Sanitary and soundly built dwellings are essential to the well being of a people. To help solve this social and economic problem of adequate shelter the Federal government in 1937 established the United States Housing Authority. By granting loans to communities the Authority helped them to demolish slums and build low rent housing units for people of small incomes.

In 1938 Congress amended the National Housing Act to the effect of home building. The legislation on reduced interest rates on mortgages and cut down payments to as low as 10 per cent. In 1947 the Housing and Home Finance Agency took over the United States Housing Authority and all other government housing activities. (For additional information see Housing.)

The cost of building or buying a home is often the largest single investment of a family. Economic experts say that the price should not exceed one and one-half to two and one-half times the family's annual income with enough additional capital to furnish the house. The subject of building and furnishing a home is so vital that many schools devote extensive courses to it.

Consideration of the site comes first. Transportation is a vital factor so the nearness to railroad station or to street-car or bus lines may decide whether a site is suitable. The convenience of schools, churches and stores also should be considered. The noise of near by

CLOTHING THE GAUNT SKELETON



To the tattoo of steel riveters, one of Chicago's big buildings mounts skyward. The Luce Tower is seen here in the process of construction. The brick and terra cotta work of the lower stories being filled in while the framework above is still uncompleted. It is a proud day for the workmen when the flag signaling the driving of the last rivet is run up.

factories or of whistling trains makes many locations undesirable. The family with growing children considers the traffic conditions in the streets for speeding automobiles in residence sections are a real danger to children. The appearance of neighboring homes should be studied carefully for well kept homes usually mean a pleasant neighborhood while shabby houses mark a district that is on the down grade. In a new suburb the matter of possible future assessments for alleys, sidewalks, gutters or sewers should be investigated as well as the tax, water and fire insurance rates.

The size of the family usually decides the size of the house desired. A two-story home with an area of 700 to 1,000 square feet is ample for a family of four or six, since a floor plan about 24 by 30 feet includes provisions for three bedrooms, bath and hall. A slightly larger plan, perhaps 26 by 36 feet, allows for four bedrooms. The style of architecture affects the space available within the house. There is a wide variety of choice—Colonial (New England, Southern or Dutch), Georgian, Norman, Spanish, English, Italian, and others (see Architecture). The architect or builder knows which style is best suited to the required demands and the United States Department of Commerce issues many helpful pamphlets which cover this subject.

Most houses now are built of fire-resisting materials such as brick, stone, tile, stucco or

concrete. Sometimes the concrete is poured in frames; sometimes concrete bricks or blocks are used. Stucco is a mixture of concrete, gypsum and sand. This is thrown up on a surface of lathing and makes a durable

and cheap surfacing material. Beams and columns for the smallest houses are sometimes made of light weight steel, of concrete reinforced with light steel rods, or of aluminum alloys. Staircases, window and door cases, etc., also are made of steel or of aluminum.

Metal lath in the walls, steel beams, and carefully built chimney flues do much to reduce the fire hazard in frame buildings, and also lower the cost of insurance. Often the walls, floors, and roofs of small homes are made of fire-proof materials.

In building a house, the best grade of materials will prove the cheapest in the end. This applies to everything that goes into the house — foundation, walls, roof, floors, plumbing, heating, and electric wiring. Here again the government helps the home builder by establishing standards of quality which are observed by the best contractors.

The foundation walls should extend at least six inches above the ground, and should reach below the frost line so they do not crack when the ground freezes and then thaws. The drainage system, it should be remembered, must be so arranged as to carry the water away from the house, for water seeping under a basement floor will soon crack the cement and cause a damp basement.

Choice of Roofing Materials

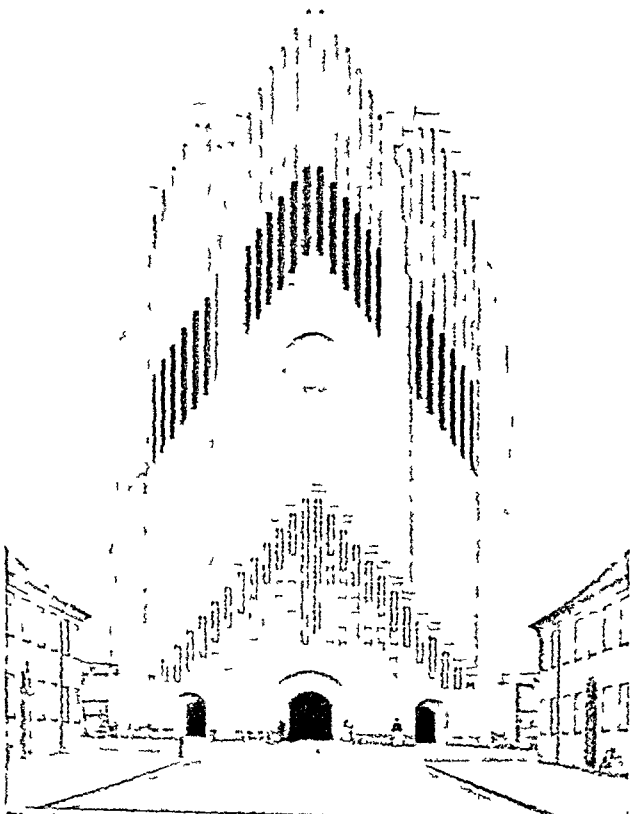
Roofs are made of materials of many sorts. Wood shingles are losing favor because of the danger of fire. Slate, tile, metal, asbestos-cement, and composition shingles of asbestos and felt all have good fire-resisting qualities. Gutters and down spouts to carry rain and melting snow from the roof should be rust-proof, and the drainage should carry the water away from the foundation wall and should not wash away the ground.

The ideal home has plenty of light, air, and running water, with the rooms arranged to give the utmost convenience. The position of the house with respect

to sunlight, winds, and view, is important. Bedrooms should be located to receive the prevailing breezes in summer. Trees on the north side may serve as a windbreak in winter, while trees to the west shut out the hot rays of the afternoon sun.

Windows should cover one-fourth or one-fifth of the floor area to insure sufficient light and air in a

MASTERLY HANDLING OF BRICK



This façade of the Grundtvig "pipe organ" church in Copenhagen, shows how the most unusual effects can be obtained by using modern methods. The architect wanted to express religious aspiration by means of the severe lines and planes of the "modernistic" style, using brick as the wall material. Such a building would have been impossible a few years ago, but modern methods provide the necessary structural strength.

room. For example, a room 12 by 15 (180 square feet), needs from 36 to 45 square feet of window space, divided among two or perhaps three windows. The ventilation and light will be poor if there are not enough windows, but on the other hand, too many windows mean a waste of heat and an unpleasantly glaring interior; and they use wall space that might be used for furniture. Windows should reach close to the ceiling, to keep stagnant air from collecting at the top of the room. They should be weather-tight to save heat, and sills should slope to drain out rain and snow. Bedrooms and kitchens should have windows on two outside walls.

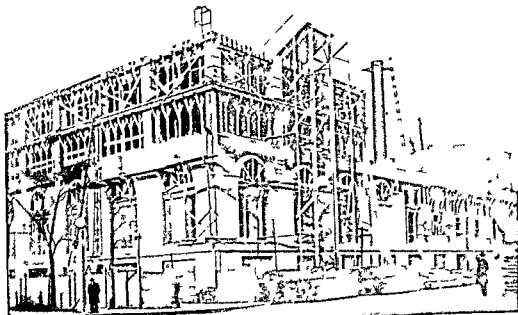
Doors and Closet Space

The number of doors likewise should be limited, because, like windows, they take up valuable wall

space that might much better be occupied by furniture. An outside door should not open into a living-room, and neither should a stairway. A large clothes closet near the entrance door is a convenience and there should be a closet in each bedroom, a general broom or storage closet, and a linen closet easily reached from all the bedrooms. Attic as well as cellar should provide extra storage space.

Concrete is a desirable flooring for laundry, porch, or cellar, and tile is popular both for the floor and walls of bathrooms. Art tile also is used as flooring for living-rooms, sometimes with a few scattered rugs. Well-laid linoleum is a serviceable covering for floors of kitchen, pantry, bath, service halls, or other rooms

POURING A WHOLE BUILDING INTO MOLDS



The framework of this building is being constructed of reinforced concrete and the picture shows the three different stages in the work. On the top story you see the wooden frame molds into which the concrete has been poured and left to set. On the second story is shown the concrete columns after the molds have been removed but with the supporting braces still in place. In the first story the framework has all been removed and the walls of stone and terra cotta have been put in place. This method of construction is very rapid.

exposed to hard usage. For wood flooring the hard woods—oak, maple, beech or birch—are most popular but excellent service is given by such soft woods as southern yellow pine, Douglas fir, or even western larch or west coast hemlock. The softer woods should be quarter-sawned else they are likely to sliver. The strips should be narrow because wide strips tend to expand or contract and require endless filling and painting.

Much of the housewife's labor comes in the kitchen and modern practise has condensed the old-fashioned kitchen into as small a space as practi-

cable with stove, sink, tables and pantry arranged to save as many steps as possible. The greatest wall space with the least floor space is desirable to provide room for tables.

Window sills should be at least three feet above the floor to allow a table beneath. Often the pantry is eliminated in favor of cabinets and the dishes are kept in a cabinet in the dining room to save steps.

There should be windows on two sides of the kitchen to provide good light and a ventilation that will carry off the odors of cooking.

Perhaps the most valuable contribution made by machinery to

EASING AMERICA'S HOUSING SHORTAGE



By 1949 more homes were being built in the United States than ever before. This boom helped solve part of the acute housing problem in the United States. He is building a new series of new homes on what was once vacant land. Much of the new housing production came from the use of this type

housekeeping is the central heating system, which permits the heat to be controlled with thermostatic devices from the living quarters, avoiding journeys to the basement. (See Heating and Ventilating.)

Planning for Good Light

As the occupants spend most of their time in the living-rooms and dining-rooms, particular care should be given to the lighting arrangements of these rooms. Windows should admit as much sun and air as possible without throwing a glare, and there should be snug corners with reading lamps where one may read with little strain on the eyes (see Lamps).

Bedrooms should have easy and inconspicuous access to the bath with windows that afford plenty of air without danger of

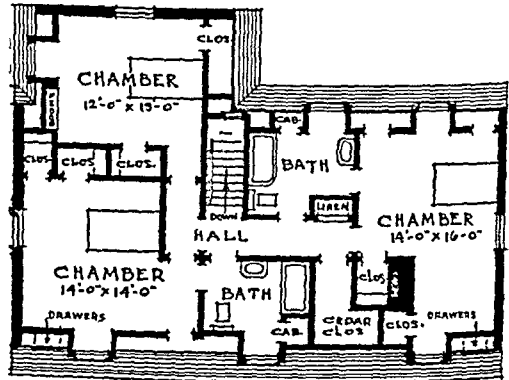
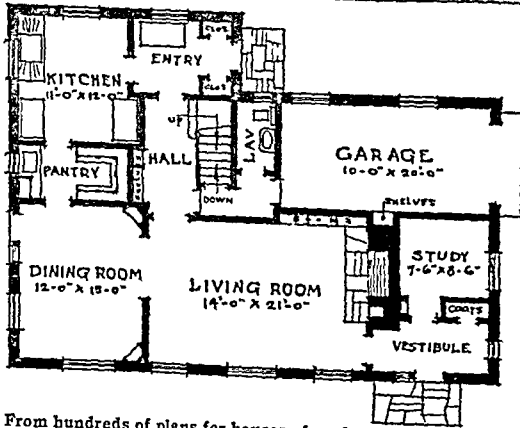
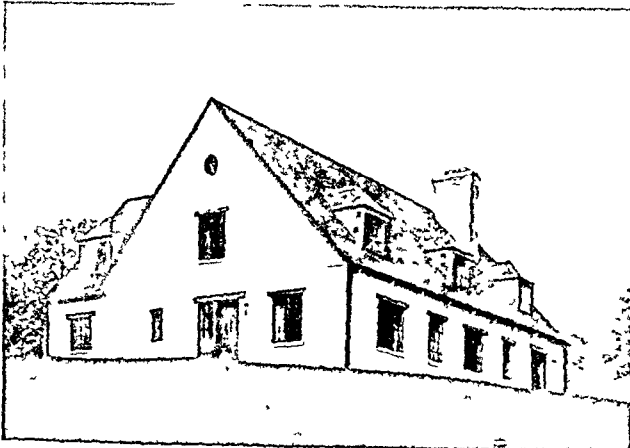
and built-in benches and even tables are seen in the breakfast room. (See also Interior Decoration.)

New Methods to Lower Costs

From time immemorial, a home has always been constructed as a unit of materials shaped on the spot. With the advent of factories, some of the most complicated pieces, such as doors and windows, came to be made in special factories, and the men on the job merely set these pieces of "millwork" in place. But for the rest, each building was still fabricated largely on the job by hand labor, at constantly rising costs.

After the first World War, architects and engineers extended the millwork principle to more of the house—walls, floors, and roofs. They learned that a few

FITS INTO RURAL SURROUNDINGS



From hundreds of plans for houses of moderate size and cost this one was selected by *House Beautiful* to illustrate the combination of simple and harmonious exterior with convenient inside arrangement. Note how the lines of the house blend in with the hill on which it stands. The architect who made this design was Raymond L. Percival.

drafts. The bathroom especially should have the best equipment the owner can afford, for such improvements as tile floors and walls and built-in tubs eliminate much unpleasant work. Proper insulation of electric wiring in the bathroom is of vital importance; hundreds of deaths and serious injuries are caused every year by electric shocks suffered in bathrooms because of poor insulation. It is equally important to insure fire-proof separation between garage and house if the garage is attached to the house.

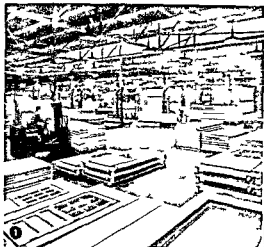
Built-in fixtures are found everywhere in the modern house. They are designed to add comfort and convenience, and often to save space. Cabinets are found in kitchens, living-rooms, bathrooms, and bedrooms; built-in bookcases are increasingly popular,

sizes and shapes of rooms could be combined differently to provide a wide variety of designs. Using these standard dimensions, much of the house could be bought as millwork and assembled at the home site.

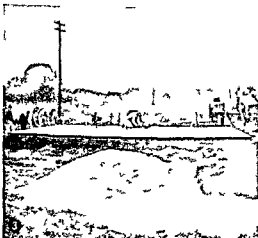
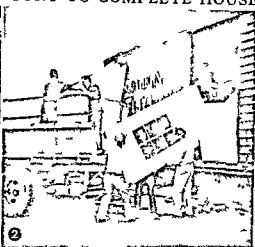
The need for military and emergency civilian housing during the second World War was met by producing prefabricated houses in factories and assembling them on the building sites. After the war, manufacturers attempted widespread sale of prefabricated houses. Some of these were made of wood; others of porcelain-covered steel. In many places they were blocked by building codes, zoning restrictions, and labor-union requirements. (See also Housing.)

A list of terms commonly used in building will be found with the entry *Architecture* in the *Fact-Index*.

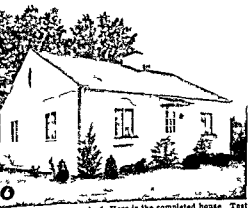
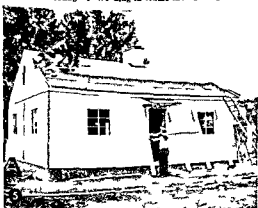
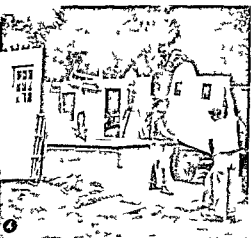
PREFABRICATION—FROM FACTORY TO COMPLETE HOUSE



1 These stacks of house sections have been mass produced in a factory. This process saves much of the time and cost spent on handmade parts for a custom built house. 2 The sections are then transported directly to the building site.



3 Construction can begin after the concrete foundation has set for two days. As sections are unloaded they are placed for quick handling. 4 Working in teams the building crew installs wall panels. The ceiling panels will be put up next.



5 After workers raise the roof sections they insert the chimney. The roof is then covered. 6 Here is the completed house. Test trials have shown that ten experienced workmen can set up a prefabricated house in five hours.

BULBS, TUBERS, AND ROOTSTOCKS. Among the earliest of the spring flowers which make our gardens and public parks beautiful are the gorgeous tulips, crocuses, and hyacinths, which boldly thrust their leaves above the ground and often burst into splendid blossom before the snows have entirely vanished.

What is the secret which enables these and other flowers to beat their rivals in the race to greet the spring? It is that they grow from bulbs, or bulblike stems, in which food has been stored through the long winter to give to the young plants a quick start over other plants which have to draw their food from the soil as they need it.

Let us see how this food is stored. Cut a tulip bulb in half, or an onion, which is also a bulb. You will see that it is made up of a number of thick fleshy layers, protected by dead tough papery leaves outside. In the center are thick little bud scales, from which the new plants grow. The broad surrounding scale leaves, as they are called, contain the food for the young plants, held in storage until they need it for their growth and development.

If you look closely at a crocus "bulb," you will see that it is different from the tulip or onion bulb. All the scale leaves are thin and papery, and the food is stored in the stem itself, which is swollen to a white rounded lump.

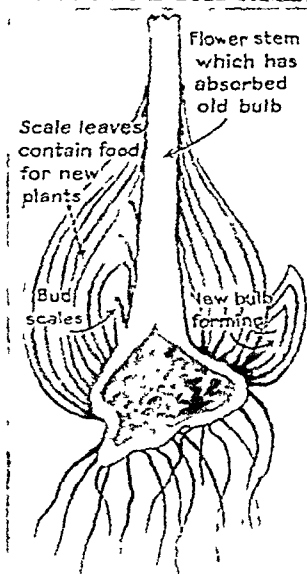
A bulblike stem of this sort is called a corm, and the familiar crocus, as well as many wild plants such as the jack-in-the-pulpit, is thus provided. Still other plants store food for the coming season's growth in

tubers and rootstocks, which are much thickened underground stems of various forms. You will notice that in the potato, which is our most familiar tuber, the scale leaves are tiny little things, with the buds in their axils. If you cut off a piece of a potato containing a bud—or eye, as we call it—and plant it in the ground or keep it in a warm place, it will sprout and begin to form a new potato plant. The iris, bloodroot, mandrake, various kinds of grasses, etc., grow from rootstocks or rhizomes, which look like large thick roots but are really underground stems because they have scale leaves.

Plants which have such underground structures, enabling them to pass through summer drought and winter cold and to develop with great rapidity during the favorable season, are called "geophytes" or geophilous plants. Nearly all the typical spring flowers belong to this class, doing all their growing between the first coming of spring and the

development of the heavy forest foliage which shuts them off from the sun's direct light. (See also Crocus; Onion; Plant Life; Potato; Tulip.)

THRIFT IN THE BULB FAMILY



This picture illustrates how the members of the far-sighted bulb family prepare for the spring flower festival.

A LITTLE NATION with a TURBULENT HISTORY

BULGARIA. The former kingdom of Bulgaria is today a Communist "people's republic" controlled by Russia. Russian forces occupied it near the end of the second World War and helped a small Communist

group to seize power. All freedom was suppressed and the country was sealed off from the outside world.

Bulgaria lies in the heart of the Balkan Peninsula, in southeastern Europe (see Balkan Peninsula). It is a small country, about the size of Ohio. In the east it faces the Black Sea. In the north the Danube River separates it from Rumania. The Balkan Mountains cross the center of the country from east to west. In the south are the rugged Rhodope Mountains. Between these two chains spreads the fertile Maritza River valley. North of the Balkan Mountains a gently rolling plateau slopes down to bluffs along the Danube.

The Bulgarians are Slavs and their language is related to Russian. Their church is a branch of the Greek Orthodox rite. Primary education has long been free and compulsory. Most of the people are farmers.

Extent.—East to west, greatest distance, about 270 miles; north to south, about 190 miles. Area, about 42,800 square miles. Population (1946 census), 7,022,206.

Natural Features.—Balkan and Rhodope mountains; Danube (forming the greater part of the northern boundary); Maritza, Isker, and Struma rivers. Climate, continental in the north, Mediterranean in the south.

Products.—Wheat, corn, barley, rye, oats; grapes, tobacco, sugar beets, potatoes; attar of roses; sheep, cattle, coal.

Cities.—Sofia (capital, 434,888); Plovdiv (Philippopolis) (125,440); Varna (Stalin), Ruse (Rustchuk) (over 50,000).

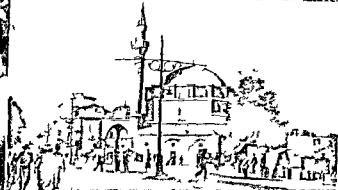
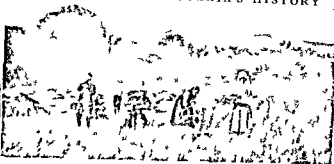
Formerly they owned their own farms, of from one to six acres. By persecution and mass arrests the state has taken over many small farms and combined them to form large socialist collectives. On both types of

farms the peasants have slowed down production because the government takes most of the crop.

On the northern plateau summers are warm, winters cold and windy. Here the peasants raise wheat and corn, barley, rye, and oats. In the protected valley of the Maritza they grow tobacco, sugar beets, fruit, and roses for attar of roses. Everywhere in the hills they pasture sheep. From sheep's milk they make yogurt, a thick fermented beverage. Cattle are kept chiefly as work animals.

The largest cities are Sofia, the capital (see Sofia), Plovdiv, and Varna, a Black Sea port. Russia has cut off Bulgaria's trade with the West, which formerly supplied manufactured goods, and has been slow to build up industries. There is consequently a severe shortage of consumer's goods as well as of food. The

COSTUMES AND ARCHITECTURE TELL BULGARIA'S HISTORY



The influence of Turk and Slav shows in the dress of the girl at the left who is richly decorated and embroidered. The farm scene above is typical of the simple methods of agriculture that still prevail. The farmer's whole family is engaged in his work, the crop is harvested by hand. Below is the Banya Bashi Mosque in Sofia, a reminder of the days when Turkey ruled the land.

chief mineral is coal (lignite). An inferior grade of uranium is mined near Sofia and shipped to Russia.

Bulgaria's Ancient Empire

In the 7th century a horde of wild Asiatic horsemen crossed the Danube and swept over the open plateau. A fierce and barbarous people akin to the Huns they made their living by war. They came from the region of the Volga River in Russia from which their name Bulgars is said to be derived. They found Slavs living in scattered agricultural villages and quickly subdued them. They gave their name to the region they conquered and set up a strong government, but they were few in number and in time they adopted the language of the more numerous Slavs.

To the patience and perseverance of the Slavic peasants the Bulgars added the aggressive qualities of a warrior race. In 811 the mightiest of all Bulgarian rulers, Khan Krum, annihilated the Byzantine army, killed the emperor and made a drinking goblet of his skull. Under Simeon (893-927) who took the title of Czar Bulgaria's power reached its zenith. Its First Empire stretched from the Black Sea to the Adriatic and south to the Aegean.

In 1014 Byzantium revived defeated the Bulgarians (the eyes of some 15,000 Bulgarian prisoners were put out) and made Bulgaria a subject state. By 1185 Bulgaria had regained its independence and again pushed out its boundaries to three seas. Under the

Second Bulgarian Empire art, commerce and literature flourished, churches and monasteries were founded. Then in 1330 Bulgaria was conquered by the Serbs and in the same century it fell with the rest of the Balkan States before the Ottoman Turks.

Struggle to Regain Lost Territories

After five centuries of Turkish rule Bulgaria's spirit again flared up. Revolts were put down with great cruelty by the Turks until finally Russia came to the Bulgarians and in the Russo-Turkish War (1877-78) in the peace settlement of San Stefano Bulgaria was allowed a measure of self rule, but the swollen territory allotted to it by Russia was taken away the same year by the other great powers in the Congress of Berlin. In 1908 Bulgaria proclaimed itself an independent kingdom with Ferdinand I as czar. Dreaming of the restoration of its empire it joined in the Balkan War of 1912 against Turkey and received the lion's share of the spoils. But in the next year its former allies wrested away all it had gained.

Bitter over its disappointment Bulgaria joined the Central Powers in the first World War. Defeat robbed it of its hold on Macedonia and its outlet on the Aegean Sea. Ferdinand went into exile and his son Boris III succeeded him. In 1919 the Peasant party came into power with Alexander Stambulsky, who had opposed the war, as premier. He broke up

all large estates and gave the lands to the peasantry. When he was assassinated in 1923 a wave of terror swept the country. Macedonian refugees who had flocked into Bulgaria from neighboring countries joined with the reactionary government in putting down the peasants and the wretched city workers. Thousands were thrown into jail, hundreds executed.

In the Second World War

In 1934 King Boris set up a virtual dictatorship. When World War II broke out, Bulgaria at first remained neutral; but its ties with the Axis were close because of its dependence on German trade. In 1940 Hitler awarded it part of Rumania (Dobruja); and in 1941 Bulgaria joined forces with the Axis. The country was used as a base for the German invasion of Yugoslavia and Greece, and Bulgarian forces were sent to occupy the Greek lands of Macedonia and Thrace. Boris hesitated, however, when Hitler tried to draw Bulgaria into the war against Russia. He died mysteriously in 1943 and a regency was set up to govern for his six-year-old son, Simeon II.

American and British air raids in 1944 aided the Bulgarian "underground" in shaking Germany's hold on the country. Anti-Nazi leaders gained control of the government and asked the United States and Great Britain for peace. During negotiations, Russia suddenly declared war on Bulgaria (September 5) in order to win a share in dictating the peace terms. On September 9 Russia accepted Bulgaria's surrender.

Soviet troops occupied Bulgaria, and it became a Russian satellite. Bulgarian Communists put down nationalist opposition by executions and mass imprisonment, ignoring American and British protests. On Sept. 9, 1946, the nation became the Bulgarian People's Republic. King Simeon II was exiled. The peace treaty of 1947 permitted Bulgaria to keep southern Dobruja, but cut off gains seized from Yugoslavia and Greece.

The United States broke relations with Red Bulgaria in 1950. In 1954, however, both France and West Germany entered trade pacts with Bulgaria. (See also Balkan Peninsula; Sofia. For Reference-Outline and Bibliography, see Europe.)

BULL RUN, BATTLE OF. The first major battle of the Civil War was fought in Virginia on Bull Run Creek, 35 miles southwest of Washington. Here Union and Confederate troops clashed on Sunday, July 21, 1861. The next day, news

that the Union troops were routed was telegraphed throughout the nation. The North long remembered that day as "dark Monday."

The North had expected an easy conquest of the South. Troops were enlisted for only three months, since it was thought that the war would be over in that time. The mob of volunteers that gathered in Washington had little idea what war meant. Officers had no time to turn them into a disciplined army. The North was impatient; the cry "On to Richmond" was raised on all sides. Yielding to popular demand, Gen. Erwin McDowell left Washington with his ill-trained troops July 16. Five days later he met the Confederate army under Gens. Joseph E. Johnston and Pierre G. T. Beauregard near the Manassas railroad junction at Bull Run. When people in Washington heard that a battle was to be fought, they hurried out to watch it as though on a holiday excursion.

At first the Union attack seemed to be successful, though Gen. Thomas Jackson's brigade stood "like a stone wall" (see Jackson, Thomas J.). In the afternoon, however, Confederate reinforcements arrived and the Union forces were driven back across Bull Run. The retreat soon became a panicky flight. Northern soldiers threw away their equipment and together with the civilian spectators fled back to Washington.

The battle of Manassas, as the South called it, convinced Confederates that their soldiers were far superior to those of the North. This conviction was shared by many persons in Europe. Although the defeat was a great humiliation to the North it brought home the fact that the war was to be a long, bitter

struggle. A new volunteer army was raised, and Gen. George McClellan was ordered to Washington to take command of it (see McClellan). A year later, the North suffered a second stinging defeat on the same field in the second battle of Bull Run, Aug. 28-30, 1862. (See also Civil War, American.)

BUNCHE, RALPH JOHNSON (born 1904). One of the finest contributions toward peace after World War II was made by the grandson of an ex-slave. He was Dr. Ralph Bunche, a Negro and former college professor. As mediator for the United Nations, he ended the war between Israel and the Arab League in 1948. This act brought him the Nobel peace prize in 1950 (see Nobel Prizes).

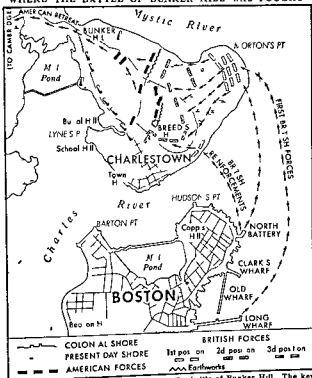
Bunche became acting mediator when his chief,

RALPH BUNCHE, UNITED NATIONS PEACEMAKER



At a United Nations General Assembly meeting in Paris, Ralph Bunche talks to Prince Faisal of Saudi Arabia, one of the Arab League nations which were at war with Israel.

WHERE THE BATTLE OF BUNKER HILL WAS FOUGHT



This map shows the course of fighting at the battle of Bunker Hill. The key below identifies the American and British positions. Although the site is completely different today, it was open country at the time of the battle. The British advanced from Boston by boat. The Charles River had not been in the city at the time of the battle and by boat the British ships could be between Boston and the site of the battle.

Count Folke Bernadotte was assassinated in 1918. His task was to work out armistices between Israel and each of the Arab nations at war. Uneasy truces had been declared, and failure of negotiations would bring renewed strife. Bunche worked with each side separately then brought them together to confer. He warned that if either side refused to agree it would be branded as the aggressor by all United Nations members. With tact and extreme patience Bunche settled differences, offered compromises, and after months of negotiations peace was declared in the Holy Land.

Stocky, athletic Ralph Bunche was born Aug. 7, 1904, in Detroit, Mich. His father was a barber. His parents died in 1916 and the boy went to live with his grandmother in Los Angeles. In high school he was a persuasive debater and was valedictorian of his graduating class. He played on the football, baseball and basketball teams and held many part-time jobs to help pay his way. In 1922 he entered the University of California at Los Angeles on a scholarship. He played on the basketball team, won a Phi Beta Kappa key and continued part-time work. Graduating in 1927, he entered Harvard on another scholarship and took his master of arts degree in 1928. There he was aided by a grant of \$1,000 from Negro clubwomen in Los Angeles.

After a year of teaching at Howard University, Bunche returned to Harvard on a fellowship. The next year he returned to Howard and in 1931 he was awarded a Rosenswald Field Scholarship to gather materials for his Ph.D. thesis. He traveled in Europe and Africa, studying colonies and mandates. In 1934 he won his Ph.D. degree and resumed teaching at Howard. During the second World War Bunche worked for the Office of Strategic Services. In 1945 he was a State Department delegate at the formation of the United Nations in San Francisco. He joined the United Nations staff in 1946. In 1930 Bunche married Ruth Harris, who had been a student in one of his classes at Howard University. They had three children. After his service in Palestine, he became principal director of the United Nations trusteeship department.

BUNKER HILL, BATTLE OF The first major battle of the American Revolution was fought at Bunker Hill, June 17, 1775. Two months had passed since the battles of Lexington and Concord had unleashed the spirit of revolt in the American Colonies. The British had increased their force in Boston and put General Howe in command. Thousands of colonial troops had gathered in the neighborhood. Washington, appointed commander in chief on June 15, had not yet reached Cambridge to take command of the army.

The American headquarters learned that Howe was planning to occupy some of the hills around Boston. To forestall him, Colonel Prescott was sent out on the night of June 16 to occupy Bunker Hill on a small peninsula in the Charles River north of the city. Prescott, however, occupied the adjoining Breed's Hill close to the waterfront.

On the morning of June 17 the British were amazed to see trenches crawling over Breed's Hill. The vessels in the harbor immediately began bombarding the fortification. Later in the day the British troops attacked it. Twice they advanced up the hill. General Putnam had given the command: "Don't fire until you can see the whites of their eyes." When the British were within a few yards of the fortifications a sheet of flame was swept down from the redoubt. The front ranks were mowed down. The others beat a hasty retreat. A third time the British charged. This time the Americans remained silent for their powder was exhausted. The patriots fought with clubbed muskets, but they were slowly forced to retreat to Bunker Hill, leaving the battlefield in the hands of the British.

It was a victory which had been dearly bought, however, for the British had lost 226 men killed and 823 wounded, while the loss of the Americans had been 145.

killed and 304 wounded. Nathanael Greene said, "I wish we could sell them another hill at the same price." Today a granite shaft 221 feet high stands near the spot where the gallant General Warren fell just as the retreat began. The cornerstone of this "Bunker Hill Monument" was laid by Lafayette in 1825, the 50th anniversary of the battle. The monument was dedicated in 1843, with an oration by Daniel Webster.

BUNSEN, ROBERT WILHELM EBERHARD (1811-1899). Our gas-burning stoves, as well as the common blow torch and gas or gasoline lights which use Welsbach mantles, are all monuments to Robert Bunsen, a German chemist. We also owe largely to him the method of spectrum analysis which gives us information about the constitution and the motions of the stars. He was one of the founders of organic chemistry. And at the very outset of his career he discovered that ferric (iron) hydrate is an antidote for arsenic—a remedy which is still standard.

Bunsen was born at Göttingen. His father, a university professor, gave him a thorough education, and in 1836, after discovering his arsenic antidote, he became a teacher of chemistry in Cassel. At that time organic chemistry was in its infancy, and chemists were concerned with the question whether inorganic elements such as metals could be combined with organic compounds. Young Bunsen proved that they could, by six years of brilliant studies devoted to organic compounds of arsenic, now called *cacodyls*. In the course of his investigations, he lost the sight of one eye in an explosion and nearly died of arsenic poisoning.

During the same period he discovered a way to end the tremendous waste of heat that resulted from the methods then used for burning pure illuminating gas (see Bunsen Burner).

In 1841 he began studying electrolysis, with his invention, the Bunsen cell, which contained carbon, zinc, and sulphuric acid. He obtained metallic magnesium, and by burning it produced a brilliant light—a discovery which is now used in the photographic flashlight. To measure the strength of such lights, he invented the grease-spot, or oiled paper, photometer (see Light).

Bunsen became a professor in the University of Heidelberg in 1852. From 1855 to 1863 he and one of his students, H. E. Roscoe, made important studies of

the chemical effects of light. By 1859 he and the university's professor of physics, G. R. Kirchhoff, were winning success in Bunsen's most important contribution to science—organizing the science of spectroscopy, whereby we can learn the chemical character of even the most distant stars (see Spectrum and Spectroscope). With this new method Bunsen discovered the chemical elements caesium and rubidium.

Bunsen invented the filter pump (1868) as well as the ice calorimeter (1870), and the vapor calorimeter (1887)—instruments used in measuring heat.

BUNSEN BURNER. In studying the composition of gases given off by blast furnaces, Robert Bunsen discovered that from 50 to 80 per cent of the heat energy

in gas was being lost. He attacked this problem and in 1855 announced a type of gas burner which would save most of this waste heat. This burner bears his name, because it was long thought that he invented it. But Bunsen was not the actual inventor, for the principle was understood and used previously by Peter Desaga and Faraday. Bunsen's contribution was to prove its value to the world.

The principle is used today in laboratories, on all gas cook stoves, and in most gas furnaces. To understand it we must examine the nature of combustion, or burning, in simple flames.

Parts of a Candle Flame

The burning candle illustrated on the opposite page is a good example of a simple flame. Most of the flame is brilliant; but at the base we

see a cuplike bluish zone, and the edge of the flame elsewhere is also bluish. Inside the flame above the wick is a dark cone.

These zones are caused by the course of combustion within the flame, or the union of oxygen with the fuel (see Fire). The fuel in the candle is melted wax or tallow, which consists of hydrocarbons (compounds of carbon and hydrogen). Union with oxygen in the air changes them ultimately into carbon dioxide and water vapor. Complete combustion, as seen at the edges and the base of the flame, produces only a faint bluish light. But there are two stages before combustion is completed.

Just above the wick, the heat changes the fuel to gas. But the gas fills this space, and no oxygen can reach it. Hence the gas cannot burn, and this zone is dark and relatively cool. Then, as the gas works outward, oxygen becomes available and burning



ROBERT WILHELM BUNSEN

starts. It is incomplete however and one result is the release of tiny carbon particles from the hydrocarbons. These particles become hot enough to glow and cause the characteristic yellow light which we see.

At the edges combustion is completed. Usually some carbon particles remain unburned and pass off as smoke, soot or lampblack.

We can prove as Sir Francis Bacon did long ago that the dark cone inside the candle flame is cool. He thrust the tip of a pointed feather quickly into the center of the cone. Most of the feather took fire immediately, but the tip did not.

How Bunsen Improved Combustion

If we light a jet of gas coming out of a plain pipe it burns with a bright flame like a candle. But this flame is not very hot. The glowing carbon particles and the soot that escapes represent a waste of fuel. Bunsen's remedy was to mix about three volumes of air with one of gas *before* the gas was ignited. Thus combustion could occur throughout the entire flame.

This is done by bringing the gas in through a small nozzle (a in the diagram) which ends inside a larger tube. One or more openings or ports in the larger tube admit air near the tip of the gas nozzle, and the upward rush of gas sucks in the needed air through these ports. A movable collar makes the air ports larger or smaller and so regulates the proportion of air in the mixture. Some burners have regulators in the base.

Parts of a Bunsen Flame

As the mixture of gas and air comes out at the top of the lighted burner it travels some distance upward before it becomes hot enough to take fire. This is indicated in the diagram by the first inner cone where the temperature is relatively low (about 600°F). Around this cone combustion starts violently, producing a second cone of blue flame. Here the carbon in the gases takes oxygen from the air with which the gas is mixed. It will also take oxygen from substances held in the zone. For example it will take oxygen from copper oxide and reduce it to pure copper. For this reason this zone is called the *reducing cone*. Around its tip is the hottest part of the flame (about 2700°F).

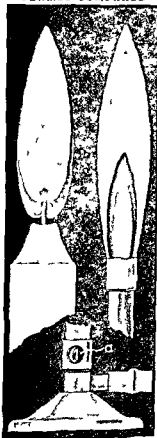
In the third or outer cone of the flame the gas has all the oxygen it needs. Substances heated here unite with any free oxygen that may be available. Hence this is called the *oxidizing flame*. Its temperature decreases gradually toward the flame's edge.

Only blow torches and the electric furnace give hot-

ter temperatures than the Bunsen burner, and blow torches including those burning gas, gas, or vapor acetylene or hydrogen use the Bunsen principle with air or pure oxygen supplied under high pressure.

The burner of an ordinary gas stove is supplied with air through ports near the petcock or valve. By closing

FLAMES COMPARED



Compare the candle flame with that of the Bunsen burner at the right. The text explains why these flames are so different. At the bottom we see the base of a Bunsen burner with its regulating collar and a gas jet (a) and (b).

ing these with your fingers you can observe how the flame would burn without its preliminary air supply.

BUNTING Among the most beautifully colored birds are the plump stocky little buntings common throughout Europe and North America. Many of them are fine singers and all are valued by farmers for the weed seeds they destroy. They build their nests of dried grasses and leaves on the open fields or in low bushes.

The purplish blue indigo bunting or indigo bird is a tan her summer resident of eastern United States. It is about five inches long. All summer long, it sings its canary like song from some high treetop. The female is brown tinged with blue on wings and tail.

In the southern and western states are the beautiful lazuli varied and painted buntings. The painted bunting is brilliantly colored with bright red under parts, dull red tail and rump, purple head and neck, and yellowish green back. The lazuli bunting shades from turquoise blue to greenish blue with brown breast and sides. The varied bunting has a purple head with back and under parts of plum red.

In the central states a modest little bird with yellow breast and brown and black streaked back chirps from weed stalks or pasture fences. He is the dickcissel, or black throated bunting. The lark bunting which nests on the western plains from Canada to Kansas is the state bird of Colorado. He is black with white

wing patches and white barred tail. The white snow bunting of the Arctic waters in southern Canada and eastern United States. The bay winged bunting or vesper sparrow, is not a true bunting (see Sparrow).

In Europe the familiar birds of this group are the corn curl snow and reed buntings, the yellowhammers and the ortolans which are taken in nets for food.

Buntings are members of the large family *Fringillidae* which also includes the finches, sparrows and grosbeaks. Scientific name of indigo bunting *Passerina cyanea lazuli*. *P. amoena* varied. *P. versicolor* painted. *P. ciris* dickcissel. *Spin. americana* lark bunting. *Calamagrostis melanocorys* snow bunting. *Electrophenax nivalis* nivalis.

The INSPIRED Tinker Who Wrote 'PILGRIM'S PROGRESS'

BUNYAN, JOHN (1628-1688) More than two and a half centuries ago, a poor tinker "dreamed a dream" in the jail where he spent 12 years of his life for his religious beliefs. This dream he made into 'The Pilgrim's Progress', a story of such universal appeal that it has been translated into more than one hundred languages and still delights both old and young in all parts of the world.

John Bunyan, the author of this world masterpiece, was born in the village of Elstow, near Bedford, in England. He came of an old family that had held land in Bedfordshire as early as 1199, but had not risen in the social scale. His father, Thomas Bunyan, was a tinker, who made and mended pots and kettles. He sometimes worked at the forge beside his own cottage, and sometimes went about the countryside from door to door.

John was brought up to his father's trade, but he was more fortunate than most boys of his class in being able for a short time to attend grammar school in Bedford. He was fond of mischief and of games and sports, particularly playing bowls and tipcat and dancing on the village green—diversions which later his Puritan conscience held sinful. Reckless, high-spirited, and imaginative, he had a ready tongue, which too often found expression in lying and swearing. "Even as a child," he says, "I had few equals in cursing, swearing, lying, and blaspheming the holy name of God." At the same time a strong undercurrent of religious feeling often filled his mind with remorse and terrifying visions.

An Age of Civil War

The period was one of great political and religious strife. Bunyan was born in the year in which the House of Commons extorted from the tyrannical Charles I his signature to the Petition of Right, a landmark in the long struggle between the English people and their kings. He died just before the outbreak of the "glorious revolution of 1688." Between these two dates occurred the bloody civil war, the establishment of the Commonwealth under Cromwell, the restoration of the monarchy under Charles II, and finally



John Bunyan was "tall of stature, strong-boned though not corpulent, had somewhat of a ruddy face with sparkling eyes, wearing his hair on his upper lip after the old British fashion. His hair was reddish, his mouth moderately large, his forehead something high, and his habit always plain."

intense spiritual conflict, the story of which is told in his 'Grace Abounding to the Chief of Sinners'. One Sunday, he tells us, after he had listened to a sermon on keeping the Sabbath, his conscience was greatly troubled; yet he went out to enjoy himself as usual with the game of tipcat. Suddenly, just as he was about to strike the "cat," a voice seemed to say to him, "Wilt thou leave thy sins and go to Heaven, or have thy sins and go to Hell?" He looked up to Heaven and imagined he saw Christ looking down

sternly upon him. But fearing that he had already sinned beyond all hope, he desperately returned to his pleasures. After a long struggle, light broke through the dark clouds, he felt freed from his burden of sin and doubt; he was filled with peace and with confidence in God's mercy.

Meanwhile he had begun to read the Bible and had joined a little congregation of nonconformists. Before long he was preaching in the villages around Bedford with such fervor and eloquence that people flocked to hear him. When Charles II was recalled to the throne in 1660 and the established English church came back to power, he was arrested for disobeying the laws prohib-



This drawing of Christian, hero of 'Pilgrim's Progress', and the drawings on the next page of other characters from the book were done by Charles H. Bennett.

the attempt of James II to re-establish Catholicism as the national religion.

When he was about 17, Bunyan enlisted in the Parliamentary army and served for nearly three years. He does not seem to have been greatly affected by the war, though it stored his mind with a multitude of military scenes and pictures which he later used with telling effect in his books. Not long after his return from the war, when he was about 20, he married an orphan girl, whose name we do not know. "This woman and I," Bunyan tells us, "came together as poor as poor might be, not having so much household stuff as a dish or spoon betwixt us both." The young wife's sole dowry was two books, 'The Plain Man's Pathway to Heaven', and 'The Practice of Piety', which her father had left to her.

Awakening of Religious Feeling

These books awakened Bunyan's interest in religion. He passed through a long period of

ing nonconformist meetings and was thrown into the jail at Bedford. There he remained for 12 years with brief intervals of liberty. At any time he might



Prison

have gained his freedom by promising to give up preaching, but he said:

If you let me out to-day I will preach again tomorrow. Hardest to bear was the thought of his family's suffering. His first wife had died and just before his arrest he had married another noble-hearted woman. She cared tenderly for his four small children, one of them a

blind daughter whom Bunyan loved especially. While in prison he supported himself and his family by making tagged almsboxes. The rest of his time he spent in reading the Bible and Foxe's Book of Martyrs, in preaching to the other prisoners and in writing religious books and papers.

At last in 1672 the King suspended the laws against religious dissenters and Bunyan was released. Three years later he was again put in prison for a few months. It was probably during this second imprisonment that he wrote the first part of *The Pilgrim's Progress*, which was published in 1678.

In the last years of his life Bunyan won increasing fame both as a preacher and as a writer. Although he frequently preached in neighboring towns and even in London, he was never prevailed upon to give up his beloved congregation in Bedford, where he found his greatest happiness in ministering to his people and quickening their zeal.



Obstinate

A characteristic act of kindness finally cost him his life. While on a journey to London, he traveled some distance out of his way to reconcile an estranged father and son and was caught in a drenching rain. A violent fever seized him and he died in London, August 31, 1688, in his 60th year.

"The Pilgrim's Progress"

In writing *The Pilgrim's Progress*, Bunyan did not know that he was creating a masterpiece of literature for of literature he knew almost nothing except the Bible. He merely had a message which he wished to give the people. In his writing, as in his preaching, he spoke to them

simply directly in plain language that they could understand.

The Pilgrim's Progress is an exciting adventure

story and at the same time an allegory of the human soul—its struggles, temptations, sufferings and final salvation. The story tells how Christian the hero bowed down with a burden of sin upon his back flees from the City of Destruction and starts on a pilgrimage beset with many perils. After being almost sunk in the mire of the Slough of Despond, he laboriously follows the straight and narrow path up the Hill of Difficulty. He goes down into the Valley of Humiliation where he battles with the



Discontent

foul fiend Apollyon and into the still more awful Valley of the Shadow of Death. He passes through Vanity Fair with all its worldly allurements is held captive by Giant Despair in Doubting Castle and at last, after crossing the bridgeless River of Death, is received in the Celestial City. The characters that Christian meets along the way represent abstract qualities and defects, virtues and vices as we can tell from their names—Obtinate, Plausible, Hopeful, Faithful, Mr. Worldly Wiseman, Mr. Talkative and all the rest—yet



Mrs. Bat's Eyes and Mrs. Know Nothing

most of them are all so real human beings who act and talk like the men and women Bunyan knew. They speak in the simple, lively, humorous language of the common people.

It was a happy accident for the world that Bunyan

had little education and knew thoroughly only one book—the English Bible. The King James Version of the Bible published 17 years before he was born is the noblest work of English prose. Bunyan lived in the Bible until its words became his own. The spiritual struggles and visions pictured in its pages were real to him. He had experienced similar struggles. He too had seen visions. He makes us see the things of which he writes because he himself had seen them. Because he could present vivid pictures in a few simple words, because he understood people and could create characters that have the illu-



Mr. Worldly Wiseman

sion of reality, and because he could tell a story with dramatic and moving vigor, Bunyan paved the way for a kind of literature that had not yet taken form—the novel. Some critics, indeed, consider him the father of the English novel.

Of Bunyan's more than 60 published works, the following are the best known: 'Grace Abounding to the Chief of Sinners' (1666); 'The Pilgrim's Progress' (Part I, 1678; Part II, 1684); 'The Life and Death of Mr. Badman' (1680); 'The Holy War' (1682).

A good biography of Bunyan is the one by James Froude, in 'English Men of Letters Series'.

BUNYAN, PAUL. The outstanding figure in American folklore is this legendary hero of the lumberjacks, a gigantic man who once ruled the whole continent.

The real Paul Bunyon (spelled with an "o") was a French-Canadian who took part in the Papineau uprising of 1837. After the rebellion he operated a lumber camp, and his crews told marvelous stories of his strength and bravery. These anecdotes fired the imagination of American lumberjacks, who delighted in their dangerous occupation and thought of themselves as a race apart from common men. They seized on Paul as a hero to personify their colorful, hearty, exciting life. But first they had him cross the border into the United States, anglicize his name to Bunyan, invent logging, and then start on his career of unmatched exploits.

By 1860 Paul Bunyan had become a legendary American hero. Gathered about the bunkhouse stove the jacks vied with one another in adding exaggerated details to the growing saga. As lumbering spread from the Maine woods to Michigan, Wisconsin, Minnesota, and on to the Pacific Northwest, each part of the country hailed Paul as its own and contributed local variations.

The Amazing Exploits of Paul and His Helpers

Ol' Paul was pictured as a typical lumberjack, but mightier than any modern man. He towered above the tallest trees, covered 24 townships at a stride when he was in a hurry, combed his curly beard with a young pine, and could let out a bellow that would cause a landslide on Pikes Peak. His best helper was Babe the Blue Ox, who measured 42 ax handles and a plug of tobacco between the horns and who could pull anything that could be "hitched onto." Johnny Inkslinger, the bookkeeper, was another invaluable aid to Paul. He figured away with a fountain pen made from a rubber hose attached to a barrel of ink—and it took a bucket brigade of 30 men to keep the barrel filled.

Paul left his mark on the map of the whole United States. The Great Lakes he made as reservoirs for Babe's drinking water; the Alleghenies and the Rockies piled up when he dug a channel for the Mississippi; Puget Sound was intended as a grave for Babe; and Kansas is flat because Paul hitched Babe to it and turned it over to make good corn land.

Paul Bunyan ruled over the woods from the Winter of the Blue Snow until the Spring That the Rain Came Up from China and discouraged his heroic lumberjacks so badly that they became ordinary men again. Then, his work ended, Paul disappeared into the forests.

For many years the tales were told only by word of mouth. As storytelling began to die out in the camps, interested listeners decided to preserve the Paul Bunyan stories as specimens of American folklore. Some of the stories were published in 1914, and since then many books have appeared. A discussion of the tales, from the point of view of storytelling, and a bibliography of some of the important collections are given in the article *Storytelling* (see also *Folklore*).

BURBANK, LUTHER (1849–1926). Because Luther Burbank developed more than 220 new varieties of trees, vegetables, fruits, flowers, and grasses, he was popularly known as the "plant wizard." His varieties were better and hardier than the plants from which

he developed them. They included a plum without a seed, a combination plum and apricot he called a "plumcot," a white blackberry, a thornless berry bush, and cacti without spines.

Luther Burbank was born March 7, 1849, on a farm near Lancaster, Mass. His father, Samuel Walton Burbank, married three times and had 15 children. Luther was the third child of his third wife. Luther was a small, shy student in the neighboring one-room school taught by his half sister. He later attended an academy.

Even as a young boy, Luther was interested in nature and mechanics. He wondered why some plants grow under water and others above ground. He made a steam whistle out of a willow stick and an old tea kettle, and before he was 15 years old he made a steam engine for his rowboat.

His uncle, Levi Sumner Burbank, head of a department of a Boston museum, often visited the big Burbank farmhouse. From his uncle and from his uncle's friend, Dr. Louis Agassiz, Luther learned many mysteries of nature (see *Agassiz*).

When Luther was 15 years old, his father sent him to work for another uncle in a Worcester plow factory. He invented a way of doing his work 30 times as fast as it had been done before.

THE "PLANT WIZARD"



Luther Burbank's patient genius created many new and better plants. Here he inspects a stalk of flowers from his Santa Rosa garden.

Luther's father died and he and his mother and his younger brother and sister moved to a small farm in the little town of Groton. Here he raised vegetables for the Lowell market. When Luther was 21 he learned from Charles Darwin's 'Animals and Plants under Domestication' that better plants could be developed through selection and new varieties created through crossbreeding or hybridization (see Plant Life subhead How Men Improve Plants).

Burbank's first successful plant was developed through selection. Potatoes are grown by planting pieces of potatoes having eyes. Only rarely will a potato plant develop seeds above ground. Burbank's sharp eyes found a potato seed ball on a plant in his garden. He planted its 23 seeds in a special plot. Each seed grew a different kind of potato. Some were poor withered things and some were no better than the commercial potatoes already grown. But one produced many large firm potatoes. Burbank replanted these and reaped a small harvest of fine potatoes. He offered the crop to a seed dealer. The dealer, after testing the new potatoes, paid Burbank \$150 for the right to market them.

Burbank determined to experiment with plant growth and he chose Santa Rosa, Calif., as the place because there he could grow plants the year around. In Santa Rosa he supported himself by working at odd jobs, and later at a nursery. In his spare time he established a small nursery of his own. This was very successful and he acquired more land. Because he was more interested in creating new plants than in making money, he turned wholly to experimental growing.

During the succeeding years Burbank, although never very well, seldom earned on fewer than 3,000 experiments at any one time. And the individual plants necessary to these experiments ran into the hundreds of thousands. At one time by grafting small branches he grew 500 different kinds of cherries on one tree. To obtain foreign plants for his experiments he corresponded with growers all over the world.

Burbank's most extensive work was with plums, berries and lilacs. In 40 years he developed more than 40 varieties of plums. In 35 years of work with berries he developed ten new varieties including the white blackberry. In 16 years of work with lilacs he developed several new forms. He also grew new forms of roses and the giant Shasta and Alaska daisies.

Burbank married twice but had no children. He loved children, however, and yearly welcomed a pilgrimage of Santa Rosa school children to his farm. He was more of a practical grower than a scientist. Much of the valuable data he gained through his experiments were lost and those that remain have never been properly evaluated and catalogued. Burbank died at his Santa Rosa home on April 11, 1926.

BURGOYNE **LEUT. GEN. JOHN (1723-1792)** The English general John Burgoyne is best remembered as having surrendered his army during the American Revolution to General Gates at Saratoga. He was a courageous, well-liked commander, a social light of London and a popular librettist and playwright.

He was the son of Capt. John Burgoyne, a London man of fashion and the grandson of a baronet. At Westminster School he became friendly with Lord Strange, eldest son of the Earl of Derby; this friendship served him well throughout his life. Burgoyne entered the army in 1740. When he was 21 years old

GENERAL JOHN BURGOYNE



This British general surrendered his army at Saratoga.

he eloped with the sister of his friend. The match was disapproved by the Earl of Derby. He gave the young couple very little financial aid. Burgoyne resigned and moved to France where he could live more cheaply.

After seven years he was reconciled with his father in law, who helped him re-enter the army. He served notably in France and Portugal. He remained in the army and was elected to Parliament.

There his chief interests were the foreign policy and the war office. He was appointed governor of Fort William, a profitable post with little responsibility, and enthusiastically entered London society. He joined fashionable clubs and became an amateur actor and a reckless gambler. In 1772 he was promoted to major general. In 1775 his play 'Maid of the Oaks' was presented in London.

In the spring of 1775 he was ordered to Boston and in 1776 to Canada. His wife died while he was in Canada. Burgoyne returned to London and drew up a plan that called for a large English force to strike south from Canada to a meeting with a force driving north from New York City. The plan was approved and he was given command of the northern army.

Burgoyne started southward with a small, poorly equipped army in the spring of 1777. He took Crown Point and Ticonderoga. His reward was promotion to lieutenant general. As autumn approached the American strength grew. The British in New York failed to come north to aid him. He lost the battle of Bennington and crossed the Hudson. The Americans maneuvered him into two defeats at Freeman's Farm and surrounded him at Saratoga. He had to surrender (See Revolution, American, Saratoga Springs).

On his return to England on parole, Burgoyne was bitterly attacked and was removed as governor of Fort William. The king refused to see him. In later years Burgoyne, though briefly active in government, turned more and more to his writing. His successful play 'The Heiress' opened in 1786. Previous to this he had made an alliance with a popular singer, Susan Caulfield. They had four children, one of them Sir John Burgoyne, became a famous British general. After Burgoyne's death in London on June 4, 1792, his children were cared for by the Earl of Derby.

BURKE, EDMUND (1729-1797). If Britain had adopted the wise and moderate policies that Edmund Burke advocated, the history of America might have been very different. During a bitter debate in the British Parliament on the question of taxing the American Colonies, one of the members hotly asked, "Should not America belong to this country?" Burke replied: "If we have equity, wisdom, and justice, it will belong to this country; if we have not, it will not belong to this country." Again and again this Irishman rose in Parliament and fought for the principles of justice and liberty. His magnificent addresses 'On Conciliation with the Colonies' and 'On American Taxation' are read and studied today.

Born in Dublin, Ireland, and educated there at Trinity College, Burke came to London to study law. His 'A Philosophical Inquiry into the Origin of Our Ideas of the Sublime and Beautiful' brought him recognition as a philosophical writer, and he became a member of the famous literary group of which Dr. Samuel Johnson was the leader. Johnson once remarked that "no man of sense could meet Mr. Burke by accident under a gateway to avoid a shower, without being convinced that he was the first man in England." Burke was soon able to support himself by his literary work, especially his review and commentary on public affairs which appeared in a yearbook, the *Annual Register*.

In 1765 Burke became private secretary to Lord Rockingham, the Whig prime minister. The next year he was elected to Parliament. He never held high office, but he at once became prominent because of his wide knowledge and his penetrating judgment. He was not a great orator, but his speeches—which were often long essays—have become classics.

Burke sharply criticized misgovernment and corruption at home in such pamphlets as 'Thoughts on the Cause of the Present Discontents' (1770) and 'On Economical Reform', ten years later. He was a conservative thinker in many ways, believing in ordered change. When the French Revolution in 1789 brought a sudden overturn of the French monarchy and a reign of terror, Burke was a vigorous critic. Liberty, he asserted, "is inseparable from order." His famous

EDMUND BURKE



This British statesman vigorously supported the cause of the American colonists in Parliament.

'Reflections on the Revolution in France' (1790) stimulated Thomas Paine's equally famous reply, 'The Rights of Man' (see Paine).

Toward the end of his political career, Burke came forward as the champion of the people of India. He moved the impeachment of Warren Hastings, governor of India, whom he charged with plundering the hapless natives (see Hastings, Warren). In this great trial Burke's attack on Hastings seems to have been unreasonably harsh, although the East India Company was shown to have been guilty of much ruthless exploitation.

In the last years of his life, Burke was nearer to the Tories than to the Whigs, with whom he had so long been connected. King George III wished to make him a peer. Before the title was conferred, Burke lost his only son, whom he loved deeply. "The storm has gone over me," he wrote, "and I lie like one of those old oaks which the late hurricane has scattered about me." A pension was all he would accept. In 1796 appeared one of the best of his writings, the 'Letters on a Regicide Peace'. It was an attack on the efforts to make peace with revolutionary France. He died the next year.

BURMA—LAND of RICE and PAGODAS

BURMA. Long before a ship reaches the hot coast of Burma, it enters a mud-stained sea. The mud comes from the rivers, which are loaded with rich soil washed down by heavy rains from the Burmese

uplands. These conditions—warmth, good soil, plenty of rain—explain why Burma can grow huge crops of rice and support a large population.

Another symbol of Burma looms up as one nears its great seaport Rangoon—the gilded spire of the Shwe Dagon Pagoda. This towers higher than the dome of

Extent, Area, Population.—North to south, about 1,250 miles; east to west, about 620 miles. Area, about 260,000 square miles. Population (1941 census), 16,823,798; (1948 est.), 18,119,000.

Climate.—Monsoon type. Annual precipitation on seacoasts, about 100 inches; on southwest mountain slopes (Arakan, Tenasserim), about 200 inches; in central basin, about 20 inches. Temperature, at Rangoon, mean 79° F., range 10°; at Mandalay, mean 81° F., range 20°.

Cities (1941 census).—Rangoon (capital, 500,800); Mandalay (163,243); Moulmein (71,181); Bassein (50,277); Akyab (48,492); Tavoy (32,964); Henzada (31,114); Prome (31,144); Insein, Myingyan, Pegu, Toungoo, Pakokku, Mergui (over 20,000).

the Capitol at Washington. It is the greatest of the many pagodas that dot the land and tell of the people's devotion to the faith of the tender-hearted Buddha, with its teachings of peace, kindness,

and the sacredness of life. Those who know the Burmese say that there is no kindlier, happier people.

Birth of the Burmese Republic

On Jan. 4, 1948, crowds of joyful citizens marched through the streets of Rangoon, the capital, shouting, "We are free! We are free!" On that day Burma cut

ties with the British Empire and became completely independent. But the birth of the republic was marked by sharp struggles for power among rival political parties. At the same time the Burmese people were learning the first hard steps of self government.

The Burmese Land and People

Burma is mostly a series of parallel mountain ranges, which extend south from Tibet until they dip beneath the Bay of Bengal (for map, see Indo-China). In the west the Arakan range, with some 10 000-foot peaks, raises a rampart against India, the northernmost portion is called the Kachin Hills. Along the eastern border runs the mountain backbone of the Indo-Chinese and Malay peninsulas. In the northeast this forms the Shan plateau, about 3 000 feet above sea level and deeply carved by river valleys. Farther south it is only a sharp ridge separating the narrow coastal district (Tenasserim) from Siam (Thailand). In central Burma, between these ridges, are the Pegu Yoma hills. Their highest point is an extinct volcano, Mount Popa (5,000 feet). Sloping up to meet the Himalayas Burma reaches its highest in the north, about 19,700 feet.

To the west of the Pegu Yoma runs Burma's greatest river, the Irrawaddy, with its main branch, the Chindwin. To the east are the Sittang and the Salween. All three rivers have filled their lower valleys with rich soil from the uplands, and together they have built a great delta out into the Bay of Bengal. The mountain barriers explain much of Burma's past. The high barrier in the northwest hampered immigration from India and prevented conquest. The population of Mongolian stock has drifted in from Greater China ever since prehistoric times. But, because they are so near to India and even for a time formed part of the Indian Empire, the people are more Indian than Chinese in their culture.

The differences among the people correspond closely to differences in the land. The most advanced of them, the Burmese, live in the fertile lowlands and make up three-fourths of the population. The highlands are held by less advanced peoples—the Shans on the Shan plateau, the Kachins in the far north, the Chins in the west, and the Karens on part of the Arakan range, in the Pegu hills, and on the Thailand frontier.

The hill peoples live in stockaded villages, and practice rude farming. They believe in nature gods and magic and they hunt heads when they can. The

most accessible of them, the Karens have been the most responsive to Christian missionary efforts.

Climate, Plants and Animals

The natural life is dominated by the monsoon climate. From October until February the cool rainless winter monsoon blows from the northeast. A hot dry season follows until the wet monsoon bursts from the southwest in late May or early June. Then the sea coasts and southwestern mountain slopes are drenched with rain. But the central interior screened by the Arakan range may get only 20 inches in a whole year. The higher Shan plateau receives a little more. Temperatures range from fully tropical at sea level to cool on the mountains and in the far north.

The seacoasts are blanketed with mangrove forests and a tangle of creepers (see Margrove). Immediately above tidewater the mangroves give way to other tropical trees. These continue up to 3 000 feet above sea level. This zone furnishes the timber trees the teak and the pyngado. Higher up, oaks and chestnuts appear and then pines. Elsewhere the central Man lalay basin is dry with thorn bushes and cactus. In the dry season even along the great river, the yellow earth becomes cracked. The river runs low and boats may be stranded for months.

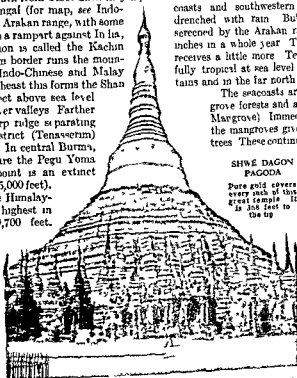
The animals include gibbons, monkeys,

elephants, tigers, and the rhinoceros. Malayan and Himalayan black bears are found in the hills. The small barking deer (*gyl*), wild oxen, and buffaloes are common. Bats and parrots sit among the trees. There are pythons and other snakes as well as lizards.

How the Burmese Use Their Land

Crowded countries in Asia envy Burma, because it seems to have plenty of room. It has an area nearly as large as Texas to support a population about equal to that of New York State. But much of the land is in the dry hill country and is ridden by malaria. In the fertile regions many tropical diseases keep the population from growing to the limits of the food supply (see Indo-China). This enables Burma to produce a surplus of rice for export.

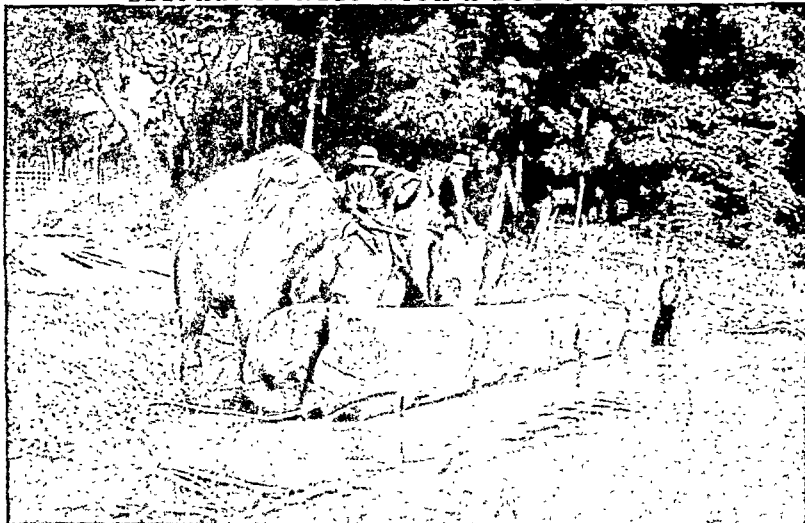
The crops range from rice to buckwheat, in keeping with the land's varied rainfall, temperature, and altitude. The best crop region is the steaming rain-drenched land of the deltas and the sea coasts. The next best land is the drier Man lalay basin. This is a region of mixed farming producing millet, sesame



SHWE DAGON
PAGODA

Pure gold covers every inch of this great temple. It is 300 feet to the top.

ELEPHANTS HELP WITH A LOG OF TEAK



The Burmese use elephants instead of machinery to do much of their heavy work. Here two tuskers are rolling a log of heavy teak into a river, so that it may float downstream to a sawmill. It may arrive two years later, because many logs are stranded on sandbars during the dry season.

beans, peanuts, corn, and cotton. Rice is grown on irrigated fields.

On the highland slopes, crops are grown chiefly for local use. Tea and rice (here grown on terraces) are raised up to 5,000 feet. There cool-climate crops begin, such as corn, beans, peas, opium poppies, and buckwheat. Some rubber has been grown in Tenasserim, but with little success because of the sharp seasonal changes between drenching rain and extreme dryness. Tobacco is a large crop, to make the huge cheroots smoked by men, women, and even children.

Forests and Minerals Are Important

More than half the country is thickly covered with forests. These supply much of the world's teakwood, which elephants drag to the rivers (*see* Teak). Other trees furnish bark for making cutch, a yellow dye used in tanning.

Burma's greatest mineral wealth is the petroleum field of the Mandalay basin, with its centers at Yenangyaung and Sinbu. Pipelines convey the crude oil to Rangoon for refining. The Kachin hills supply the world's finest jade. This is carried to China for sale as "Chinese jade." The Shan plateau has highly developed sil-

ver and lead deposits, large beds of lignite, and ruby mines (*see* Jewelry and Gems). Tenasserim yields tin and some tungsten. Iron, zinc, copper, nickel, and gold are also mined on a small scale.

Oppressive climate and lack of good coal and iron have held back manufacturing. Most of the mills process raw materials such as rice, timber, and cotton. The chief exports are rice, petroleum, and cotton, which go mostly to India. Others are teak and minerals. Important imports are cotton goods, machinery, and other manufactures.

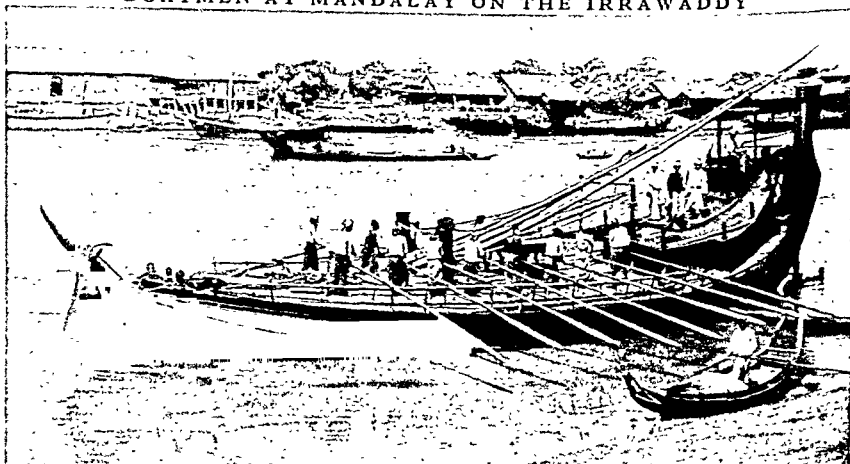
Rivers Instead of Roads

In this land of mountain barriers and seasonal floods

there are only some 4,000 miles of improved highways. The delta has virtually none except the road northward from Rangoon. At Lashio begins the famed Burma Road, which links the railhead with Kunming in southwestern China. Rangoon is connected by narrow-gauge railroads with Moulmein and Mandalay, and another line connects Mandalay with Lashio. Far to the north the Stilwell Road, built to supply Allied forces fighting against the Japanese in the second World War, crosses Burma from China to Assam.

The rivers are the main routes of transportation. The Irrawaddy is navigable by large steamers the year around as far as Bhamo, 900 miles up. Small craft can travel a hundred miles or so farther north in the

BOATMEN AT MANDALAY ON THE IRRAWADDY



The graceful lines and the two-piece mast of this Burmese craft remind one of the ancient river boats of the Nile and the Tigris. The same curving lines appear in the rowboat on the near river bank. The sheds on the farther bank are set on piles to be above flood water.

many season. Native boats use the Salween for local trips between the many rapids, as far north as the Chinese border.

A Land of Few Cities and Many Villages

Rangoon, the capital, largest city and chief port, is near the tip of the delta. A few miles east across the Gulf of Martaban in Tenasserim is Moulmein, heart of the tin region. The only other large city is the old capital, Mandalay, which stretches for some six miles along the Irrawaddy in central Burma. Its noisy bazaars, many pagodas and monasteries, and its mixed population of Burmese, Chinese, Hindus, hill-men, and whites make it a fascinating place to visit.

Most of the people live in villages set on piles to escape floods and the water used to irrigate the rice fields. The houses are built of bamboo or teak-wood, with thatched roofs. The only furniture is a low table and grass mats. Around these homes the farmers work their fields with water buffalo or small humped oxen.

Some towns have bazaars, but many depend upon bazaar boats. These floating stores buy the villagers' wood carvings or silverwork and sell the few articles the people need. The great staple is cloth for the jackets and skirts that both sexes wear.

Modern Problems

The Burmese are better educated than most Orientals. Each village has its pagoda and its yellow-robed Buddhist priests, who teach the children to write a script akin to the ancient Pali alphabet of India. The language, however, is like Chinese. There is a university in Rangoon. Burma has no caste system and women enjoy more privileges than is common in the Orient. They have the right to vote, and they do much of the small business, for the men are inclined to be indolent.

The country has been a notable field of American missionary endeavor ever since the time of the Rev. Adoniram Judson, who began work at Rangoon in 1813. Many converts, the compilation of a Burmese grammar and dictionary, and a Burmese translation of the Bible were among the fruits of his 37 years' service in the country.

Education awakened the younger Burmese to their economic plight. The older generations had so disliked work that they had permitted foreigners to establish and manage nearly all Burma's business. The large industries had been built up by the British. Hindus and Chinese controlled most of the small

mills and stores. When Burma became an independent republic in 1948, its socialist government planned to take over gradually the nation's natural resources and basic industries.

The History of Burma

Burma's early history was a long record of wars with its neighbors and internal struggles to win and hold royal power. In the 17th century the Portu-

guese Dutch and English set up trading posts. Only the English kept a foothold. Following the Burma wars (1826-32) Great Britain spread its control over the entire country formally annexing Burma in 1886. In 1919 Burma was joined to Britain's Indian Empire as a province. It was separated from India and made a crown colony in 1937.

In March 1942 Japan invaded Burma. Many fifth columnists welcomed the Japanese as liberators. But exploitation embittered most Burmese and they formed an extensive underground to aid the Allies in Burma (see World War Second). Britain again took over the government in 1945 and in 1946 restored partial self rule. After the war Burma seethed with internal strife. Robber bands roamed the country and Communists incited strikes. But in 1947 Burma's constituent assembly voted to form a republic, called the Union of Burma. Britain then permitted Burma to withdraw from the British Commonwealth of Nations.

The Union of Burma became an independent nation on Jan. 4, 1948. The constitution established a parliament. It elects the president for five years. He has no veto. Buddhism holds a "special position" as the "preferred faith" of the mass of people.

Burma fell into turmoil. Political groups warred among themselves and many able leaders were assassinated. Karen guerrillas fought for independence. The faltering nation seemed ready to succumb to Communism. To save Burma, India and Britain gave it loans, the United States gave it a grant in exchange for strategic raw materials. By 1954 Burma had made considerable progress and declared it would stand with Southeast Asia in resisting Communism. (For Reference-Outline and Bibliography, see India.)

BURNS, ROBERT (1759-1796) In the years when the United States was winning independence from England, a Scottish boy was doing a man's work on his father's farm. But his thoughts were far from the fields. In his pocket he had a book of poetry or an

DRESSED FOR BURMA'S SUN



This young girl tops her turban with a huge straw hat to ward off the hot sun. Both men and women wear loose, short jackets and wrap around skirts like these. They are airy, yet keep out heat.

old play or some other volume from his father's slender library; and when the horses would rest at the end of a furrow, he would snatch a few hasty glances at the words he loved so well, to turn them over and over in his mind while he plodded down the next furrow. And at night he loved to try his hand at writing verses picturing his admiration for some pleasant-faced lassie, or describing the sights and sounds of his life in the fields. All living things were dear to him, and when his plow relentlessly uprooted a mountain daisy he would pause to mourn in such matchless lines as these:

Wee, modest, crimson-tipped flower,
Thou'st met me in an evil hour;
For I maun crush amang the stour
Thy slender stem.

And if some terrified little field mouse were driven by a similar mishap from his warm underground home, the boy would grieve for the "wee, sleekit, cowrin', tim'rous beestie."

Such was the boyhood of "Bobby" Burns, Scotland's greatest poet, whose songs of humble life have sung themselves into the hearts of the world. He was born near the village of Ayr in such a home as he pictures for us in "The Cotter's Saturday Night." His father was a fine type of Scottish peasant, honest, knowing, and god-fearing; but his unceasing toil from morning till night could barely wrest a livelihood from the stubborn soil, and Bobby, the eldest of seven children, was forced at 13 to begin his labor on the farm and at 15 to do a man's work.

But hard though their life was, Bobby and his brothers and sisters enjoyed many precious hours when the day's toil was done, listening while their mother sang to them songs of early days, or hearing their father read aloud the stirring tales of the Bible. The whole family loved to read, and visitors dropping in at mealtime would sometimes find them all seated around the table, a spoon in one hand and a book in the other. But "the unceasing toil of a galley-slave" overtasked the youthful poet's strength and threw him into fits of melancholy from which in later youth he sought refuge in the gay tavern life of the village, forgetting his sorrows in scenes of what he called "swaggering riot and roaring dissipation."

The "Ploughboy Poet" Leaps into Fame

By the time he was 26 his father had died, and Burns, discouraged by the hard struggle against poverty as well as by a disastrous love affair, decided to leave for the island of Jamaica to begin life anew. To get money for this venture, he published a volume of the verses he had been writing since boyhood. They met with instant success, and the fame of the "Ayrshire ploughman" grew so great that Burns gave up his plan to emigrate. He received about \$100 for

his share of the profits on his book of verse, a single copy of which is now worth thousands of dollars. With this money he went to Edinburgh, where he was flattered and feasted, petted and lionized by the learned and wealthy. After a season the novelty of the ploughboy poet wore off, and the fickle crowd forgot him. Burns, who had received all their attentions with simple dignity, went back to Ayrshire, unaffected as before, not without some feeling of bitterness toward those of high station, but with a stronger love than ever for the common man.

In 1788 he married "Bonnie Jean" Armour, whom he had long loved, and soon after he received an appointment as inspector of the liquor customs, which, together with his farming, promised to secure him a livelihood. But the new office proved his undoing, for he was thrown more than ever into riotous company. Weakened by drink and dissipation, he contracted a fever, and died at the age of 37.

In spite of his frailties, Burns was a fine lyric poet. The spirit of Scotland is in his verses, and some of his best poems are in Scottish dialect.

But Burns's humanity embraces the world, especially in poems like 'A Man's a Man for a' That':

The rank is but the guinea's stamp,
The man's the gowd (gold) for a' that.

Burns revealed the many sides of his nature in his songs. His patriotism rings in such verses as 'Scots Wha Hae wi' Wallace Bled'. His romantic self is expressed in his love songs, 'My Jean', 'A Red, Red Rose', 'The Banks o' Doon', and 'Highland Mary'.

In addition to those mentioned, Burns's poems include: 'To a Mouse', 'To a Mountain Daisy', 'Address to the De'il', 'Address to the Unco' Guid', 'A Bard's Epitaph', 'Auld Lang Syne', 'John Anderson, My Jo', 'My Heart's in the Highlands', and 'Tam o' Shanter'.

BURR, AARON (1756-1836). Today Aaron Burr is remembered as a storm center in early American political life. Out of all the controversy and charges, public memory fastened upon two facts: Burr killed Alexander Hamilton in a duel, and his enemy, Thomas Jefferson, had him tried for treason. Although the duel was fair and there was no creditable evidence of treason, the two episodes obscured other facts in an actually notable career.

Burr started life well. His father, Rev. Aaron Burr, was president of the College of New Jersey (now Princeton). Burr was born at Newark, N. J., Feb. 6, 1756. His parents died early and he was brought up by an uncle. Burr was short, well mannered, and likeable. He was a capable army officer in the Revolutionary War but resigned because of ill health. He then studied law and won quick success in practise.



ROBERT BURNS
The Ploughboy Poet

In 1782 he married and had one daughter, Theodosia Burr held several offices in New York State then became a United States senator

In 1800 he was Thomas Jefferson's running mate in the presidential election Through a defect in the election procedure at that time, Jefferson and Burr received equal numbers of votes in the electoral college Jefferson was angered because Burr did not disclaim the presidency The House of Representatives decided the issue, choosing Jefferson president and Burr vice-president (see United States Constitution, Vice-President) In 1804 Burr, still vice-president, ran for governor of New York and was defeated The campaign had been bitter Burr demanded that Hamilton retract statements he had made Hamilton was evasive and Burr challenged him Hamilton was killed in the duel Burr completed his term as vice-president, although indicted for murder in New York and New Jersey

Burr next embarked upon an ambitious scheme in the west, with financial help from a wealthy Irishman, Harman Blennerhassett Blennerhassett had built a large home on an Ohio River island near present-day Parkersburg, W Va Burr took 60 men in boats down the Ohio, apparently to colonize an area west of the Mississippi Burr was accused of planning to create an empire in Mexico and to make the southwestern states a part of his scheme The charge led to his trial for treason, but Burr was acquitted

Burr then sailed to Europe and remained four years He returned in 1812 and again took up the practice of law He made his home in Port Richmond, on Staten Island and died there Sept 14, 1836

BURROUGHS, JOHN (1837-1921) President Theodore Roosevelt once wrote a letter to John Burroughs, the famous nature essayist in which he said "It is a good thing for our people that you have lived, and surely no man can wish to have more said of him" The poet Walt Whitman, who was also a close friend of Burroughs, said of him, "John is one of the true hearts warm sure firm" John Muir the world-famed naturalist, also thought highly of John Burroughs but it was probably America's young people who loved Burroughs most He in turn loved them deeply and never hesitated to help and advise them

He was once asked to write to a class of children who were studying the art of writing This was what he wrote "I think I have got more help as an author from going fishing than from any textbook or class-book Your teacher will not thank me for encouraging you to play truant but if you take Bacon's or Emerson's or Arnold's or Cowley's essays with you, and dip into them now and then while you are waiting for the fish to bite, she will detect some fresh gleam in your composition when next you hand one in"

Not many boys however, make fishing what John Burroughs made it, an opportunity to study nature and the best essayists at the same time The letter is not so much advice as it is a revelation of the man Burroughs, who more successfully than any other writer of his age joined nature study with literature

and the lives of men Thoreau lived alone at Walden Pond, but Burroughs could do this and turn from it to find pleasure in tramping and arguing with his friends both young and old During his lifetime these friends by the thousand made pilgrimages to his simple cottage Slabside near the Hudson River opposite Poughkeepsie

THE PHILOSOPHER STUDENT OF NATURE



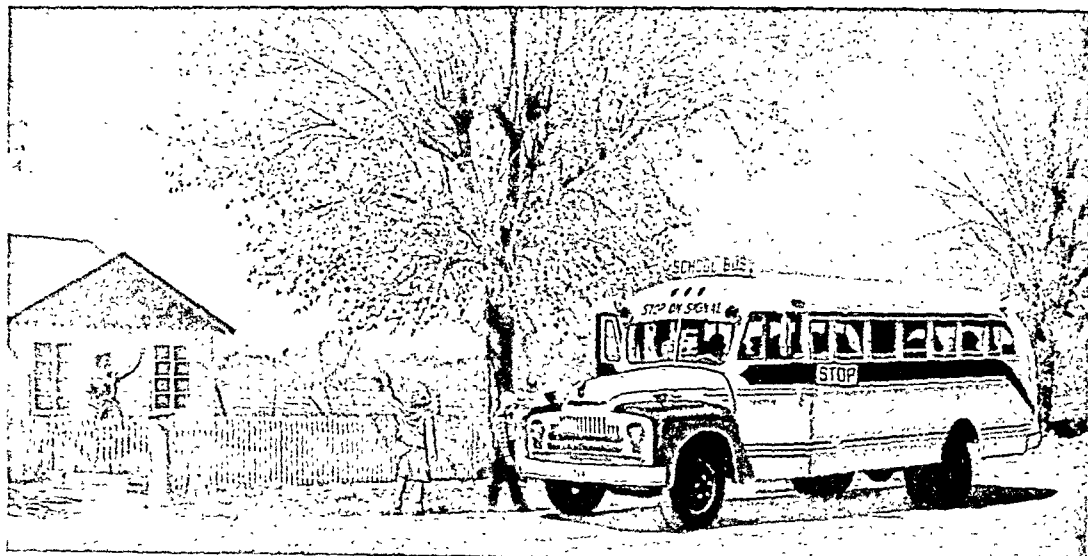
John Burroughs is said to have read "sermons in stones and books in the running brooks" His essays are distinguished by their original thought and literary charm

Burroughs grew up on a farm in New York State He began writing early, composing his first essays when he was 14 At 24 the *Atlantic Monthly* bought one of his essays and he soon sold articles to many other national newspapers and magazines It was many years however, before he could earn a living from his writing

To support himself Burroughs taught a country school for eight years He then went to work as a clerk in the Treasury Department in Washington, D C, for ten years Later he became a national bank examiner, but business never appealed to him He wanted to devote all of his time to living in the country and writing

Finally, at 46, he was earning enough money from his writing to be able to break away from business and build his country house on the banks of the Hudson River Here he lived quietly, raising fruit and vegetables carrying on a wide correspondence, and writing articles and books

Among Burroughs' best-known works, with their dates of publication are 'Wake Robin' (1871), 'Winter Sunshine' (1875), 'Birds and Poets' (1877), 'Whitman, a Study' (1896), 'Squirrels and Other Fur Bearers' (1900), 'Ways of Nature' (1905), and 'Camping and Tramping with Roosevelt' (1907).



PROVIDING *Over-the-Road* PASSENGER SERVICE

BUS. In 1914 a young Swedish immigrant, Carl Eric Wickman, opened an automobile agency in Hibbing, Minn. One of the first automobiles he tried to sell was a seven-passenger touring car, but no one wanted to buy it. Wickman decided to use the car to carry passengers between Hibbing and Alice (now South Hibbing). Taxis had been charging \$1.50 to \$3.00 for this trip. Wickman set up a regular schedule, charged 15 cents one way and 25 cents for a round trip.

This was the first scheduled *intercity* motorbus line in America. It grew into the Greyhound Bus Company, the largest transportation company in the world. Annually the "Hound" carries more than 225 million passengers in 6,000 buses over 10½ billion miles on a 96,000-mile web of lines that extend into almost every state. This is about half the total intercity bus passenger miles traveled yearly by all buses in the United States. Competing with Greyhound are more than 5,000 bus companies. Among the largest of these is the National Trailways Bus System.

Because buses, like automobiles and trucks, can go where railroad trains cannot, they are an important part of America's vast transportation network. Twenty-nine states have one or more counties without railroad service. Buses also supply cheaper transportation than do the railroads or airlines, although they do not travel as fast. (See also *Automobile; Truck; Railroads; Transportation.*)

While Wickman was founding his bus company in Minnesota, intercity bus service was also being de-



Forerunner of the modern school bus (top) was the 1920 model (bottom). In many places increased use of the yellow school bus has brought about the closing of the "little red schoolhouse" and the growth of centralized consolidated schools.

veloped around Los Angeles. Here suburban towns were being built beyond the streetcar service, and people with cars began picking up passengers, charging them a nickel a ride. Since "jitney" was slang for five cents, the term "jitney bus" was coined. The jitney craze soon spread all over the United States. About this time intercity bus service also began in the Pacific Northwest. Many other intercity lines were started by local livery stable operators in various parts of the country.

Local transit, or *intracity*, buses were in use before intercity buses. As early as 1905 a 24-passenger double-decked motorbus was in service in New York City along with the customary horse-drawn omnibuses. In 1912 gasoline buses were operated in Cleveland, but as late as 1920 there were less than 100 city buses in the entire country. Today 60 per cent of all city passengers using public transportation travel by motorbus, and more and more cities are changing to an all-bus system of public transportation. Most buses have gasoline or diesel-powered engines. City buses, however, often have engines that burn bottled gas instead of gasoline. Some cities have "trackless trolley buses," which are powered by electricity received

from an overhead wire through a trolley (see Street Railways)

Types of Modern Buses

The development of the school bus has helped make it possible to close the local rural small schools and replace them with improved consolidated schools. Local transit buses also take young people to school in the city. More than 130,000 buses annually carry about 8 million students to school in the United States.

Until 1920 most buses were converted automobiles. Then Frank and William Fageol built the first vehicle actually designed as a bus. The Fageol Safety Coach was for many years the standard bus design throughout the United States and Europe.

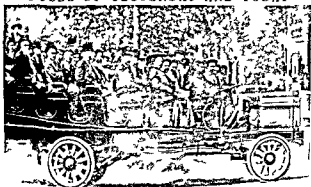
Today's buses are a great improvement over the 1920 models for both safety and comfort. Modern lightweight alloys make it possible to build highway giants that are light yet strong. Many cross-country buses have lavatories, water coolers, buffet service, card tables and space so travelers can walk about. Newest features include air conditioning, observation domes and two-way radio service between the buses and the dispatching center. Today there are about 250,000 motorbuses in use in the United States and about 760,000 throughout the world. Most of these are manufactured in the United States.

Regulating Bus Transportation

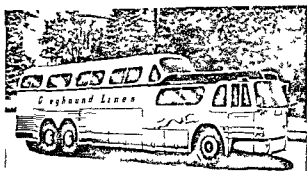
In the early days of bus transportation many regions were deluged with offers of transportation for the public and unscrupulous individuals took advantage of this. Rides were sold for which no transportation existed. Serious accidents occurred and mechanical breakdowns would leave passengers stranded. Competition between bus lines and between the bus lines and the railroads was so keen that bankruptcy of the companies often resulted. The poor condition of roads and streets also made early bus transportation difficult (see Roads and Streets).

The bus industry came of age with the gradual improvement of America's roads and with the passage of the Motor Carrier Act in 1935. This act requires that any prospective bus operator secure a certificate of public convenience before starting service. To get this certificate from the Interstate Commerce Commission, the applicant must prove that his proposed service is needed and desired by the public; that it is not likely to constitute destructive competition for existing services; and that he is financially and otherwise qualified to render service in accordance with legal city, state and federal standards (see Interstate Commerce Commission).

BUSES OF YESTERDAY AND TODAY



One of the most popular types of early buses was the eight-seater Fageol Safety Coach. Note the solid rubber tires and chain drive.



This sleek cross-country giant with its raised observation dome was put into service for the first time in the summer of 1954.



Newest city buses carry as many as 50 passengers. Engines are usually at the rear and gear is a shift ed automatic.

Following the passage of the Motor Carrier Act the bus industry proceeded to develop swiftly. Routes were lengthened and consolidated and central terminals were established. Arrangements for interline transfers and through tickets were perfected. Coordinated schedules were developed by connecting carriers to expedite the journeys of through passengers whether their destinations were three or three thousand miles away.

BUTTER. Making butter by churning the fat in milk is a simple process. The first butter was probably made by accident. Prehistoric people used animal skins to hold liquids, and the first person who carried a skin bag of milk on a jogging horse would find butter floating on the milk.

Ancient Sanskrit writings and the oldest books in the Bible mention the use of butter. The Greeks and Romans used it largely as a medicine, for they preferred olive oil as a cooking fat. Through the centuries many kinds of churns were invented. The commonest was the earthenware jar with a wooden dasher. The housewife plunged the dasher up and down in the cream until butter appeared. She collected the yellow butter granules, worked out the milk with cold water, and then added salt to make the butter keep better. All America's butter was made in farm kitchens until the creameries were built in the late 19th century.

Today a huge dairyming industry collects the cream from the farms, manufactures the butter, and delivers a standardized product to stores and homes. Butter may be made from sweet or sour cream.

Government regulations require that it contain not less than 80 per cent fat. (See also Milk; Dairying.)

Since butter is so largely fat, it is a valuable energy food, with an average of 3,410 calories to a pound. It is the chief source of vitamin A in the American diet. It also contains small amounts of vitamins D and E and various minerals. When cows are on pasture in summer, the butter is yellower and richer in vitamin A than in winter. It may be tinted a uniform shade with a harmless coloring material.

Butter dealers classify the quality of the product according to a grade or score, assigning points for flavor, body, color, salt, and type of package. The grading system set up by the United States Department of Agriculture has the following classifications: Grade AA, or 93-score; Grade A, or 92-score; Grade B, or 90 score; Grade C, or 89-score.

The American people eat less butter than they once consumed. In the 1890's more than 22 pounds were produced for each person in the country. Today each individual's share of the national output is less than half this amount. For cooking, people use vegetable oils instead of butter, and as a table spread oleomargarine has gained favor (see Oleomargarine).

The United States is the chief butter-producing country of the world. The leading states are Minnesota, Iowa, and Wisconsin. Other important producers are Nebraska, Missouri, Ohio, Illinois, Michigan, Indiana, and Kansas. Countries with a high output include Canada, Australia, New Zealand, France, Germany, Denmark, the Netherlands, and Sweden.

Though most butter is churned from cow's milk, in certain countries it is made from the milk of other animals of the region. Among these animals are water buffaloes, yaks, zebu, camels, mares, llamas, reindeer, sheep, and goats. In India and Central Asia a form of clarified butter, called *ghee*, is made by boiling the water out of butter and adding salt and sometimes sour milk and herbs. Tibetans are especially fond of it. They drop lumps in their tea.

THE SWAMP BUTTERCUP



In low, marshy places the swamp buttercup blossoms from May to August. It is very similar to its relatives of the fields.

BUTTER-AND-EGGS. A common wild flower of fields and waste places is the butter-and-eggs. The name comes from the color of the butter-yellow and orange blossoms. They are shaped like the garden snapdragons, to which they are related, with a two-lipped corolla and a long, hollow spur (for illustration in color, see Flowers). The leaves are long and grasslike.

A native of Europe and Asia, the butter-and-eggs now grows throughout the United States and southern Canada. It is also called yellow toadflax. It belongs to the figwort family, *Scrophulariaceae*. The scientific name of the butter-and-eggs is *Linaria vulgaris*.

BUTTERCUP. The butter-yellow glossy petals of these familiar wild flowers brighten marsh and meadow from early spring until autumn. They lie in shining patches in the fields, avoided by grazing animals who dislike their bitter juices.

Buttercups belong to the crowfoot family (*Ranunculaceae*), and crowfoot is another common name for these flowers. The scientific name of the genus (*Ranunculus*), "little frog," was given them because they are abundant in moist places frequented by frogs. They live in temperate climates throughout the Northern Hemisphere. About 40 species are found in the United States and Canada. The flowers have five to seven petals and numerous stamens and pistils. The leaves in many species are composed of three leaflets, each one three-lobed and deeply notched. The stems are usually hairy and from four inches to three feet tall.

One of the earliest to bloom in the northern United States is appropriately named the early buttercup, or early crowfoot (*Ranunculus fascicularis*). The common buttercup, or tall crowfoot (*R. acris*), has been naturalized from Europe. It grows to be two to three feet tall. The bulbous buttercup (*R. bulbosus*) grows from a bulblike root. The bulb may be transplanted to gardens in the late fall. The marsh buttercup (*R. septentrionalis*) grows one to three feet tall in swampy places. Yellow water crowfoot (*R. delphinifolius*) and bristly crowfoot (*R. hispidus*) are also water dwellers. The small-flowered crowfoot (*R. abortivus*) is the most weedlike member of the genus. The common western buttercup (*R. Californicus*) has 9 to 16 petals.

BUTTERFLIES and MOTHS

—the BEAUTIES

of the INSECT WORLD

BUTTERFLIES AND MOTHS To a poet butterflies and moths are like fluttering flowers. Scientists know them as a group of insects which make up the order *Lepidoptera* meaning 'scale wings'. They are so named because their wings and certain portions of their bodies are covered with a fine dust. Under a microscope the dust is seen to be made up of millions of finely ridged scales which are arranged in overlapping rows. Each scale has a tiny stem which fits into a euphrase socket. The beautiful colors and markings of the insect are due to the scales.

Butterflies and moths look very much alike. The best way to tell them apart is to examine their antennae or feelers. Butterfly antennae are slender and the ends are rounded into little clubs or knobs. Moth antennae lack these knobs. Many of them look like tiny feathers and some are threadlike (for pictures of antennae see Insects).

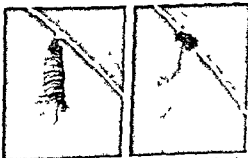
Most butterflies fly and feed during the daytime. Moths fly at night. Butterflies rest with their wings held upright over their backs and moths with their wings outspread. These are not safe rules to follow however for some moths are lovers of sunshine and some fold their wings. The honors for beautiful coloration are about evenly divided. The pale green luna moth and the rich reddish brown cecropia moth are as handsome as any of their gay cousins.

Different kinds of butterflies and moths live throughout the world—in temperate regions high in snowy mountains in deserts and in hot steamy jungles. They vary in size from the great Atlas moth of India which is ten inches from tip to tip of the spread wings to the Golden Pygmy of Great Britain which is only one fifth of an inch across. In North America north of Mexico there are 8000 kinds of moths but only 700 kinds of butterflies.

Like all insects the butterflies and moths have three pairs of legs and a body which is divided into three sections—head, thorax and abdomen. On the thorax or middle section of the body are two pairs of wings. The pair in front are usually the larger. The scales on the wings contain a pigment which gives the insect some of its color. Certain colors however and the iridescent shimmer come from the fine ridges on the scales. The ridges break up the light into the various colors of the spectrum. The beautiful blues for example are due to the way in which the light strikes the scales.



This series of pictures shows the life history of a monarch butterfly. From an egg attached to a milkweed leaf (left) a caterpillar hatches (right). It grows by breaking out of its skin (molting). The black shriveled object is the cast skin.



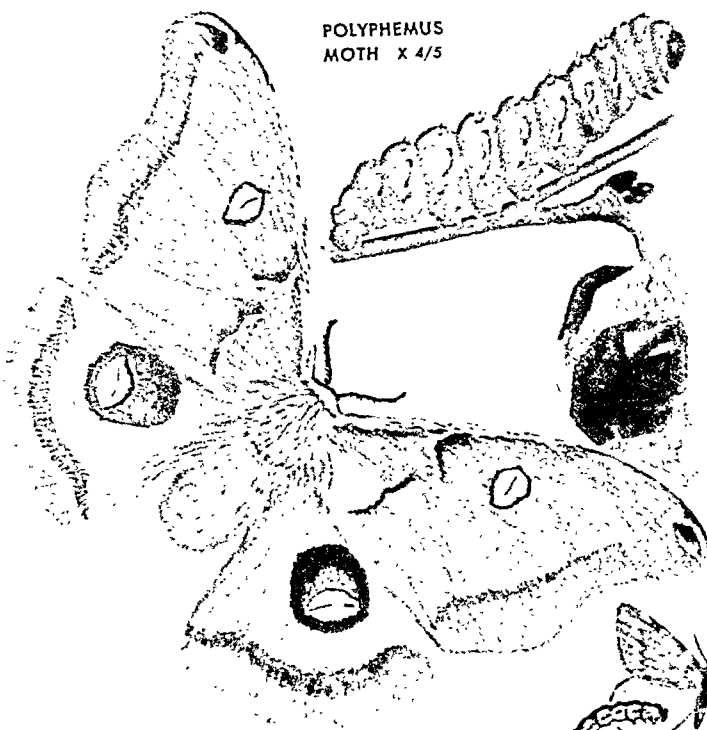
The full grown caterpillar (left) is turning into a chrysalis. The old skin is half rolled back showing the chrysalis underneath. Note the silk button by which it hangs. At right the skin is removed but the chrysalis is still contracting.



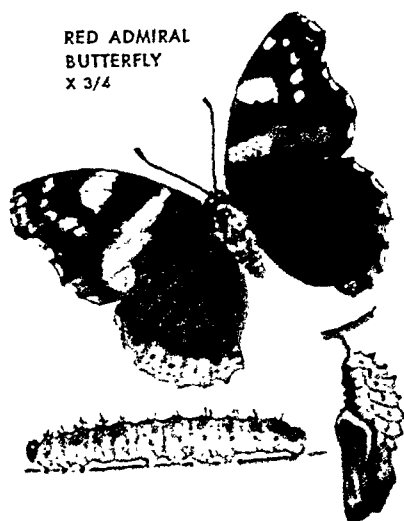
The chrysalis is a beautiful object of jade green studded with gold. Now it is quiet while great changes take place inside. In about two weeks it turns purple then black and transparent. It cracks open and from it emerges the adult butterfly (right).

These insects feed on the nectar of flowers and on other plant liquids. The mouth is a long slender sucking tube. When it is not in use it is coiled up like a delicate watch spring. By uncoiling the tube the insect probes deep into the flowers and sucks up the nectar. Some kinds have spines on the tip of the tube which tear the plant tissues of ripe fruits and start the juices flowing. Certain kinds have imper-

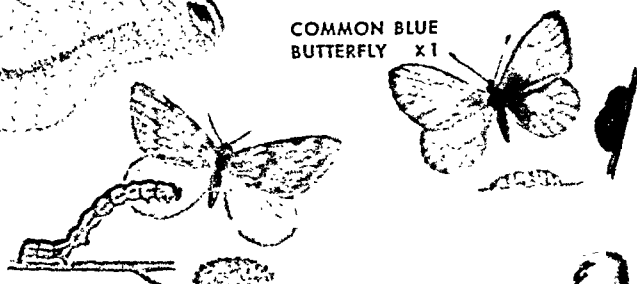
POLYPHEMUS
MOTH x 4/5



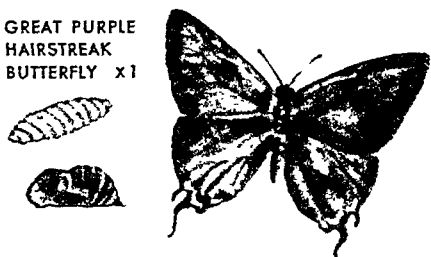
RED ADMIRAL
BUTTERFLY
x 3/4



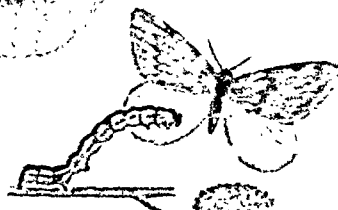
COMMON BLUE
BUTTERFLY x 1



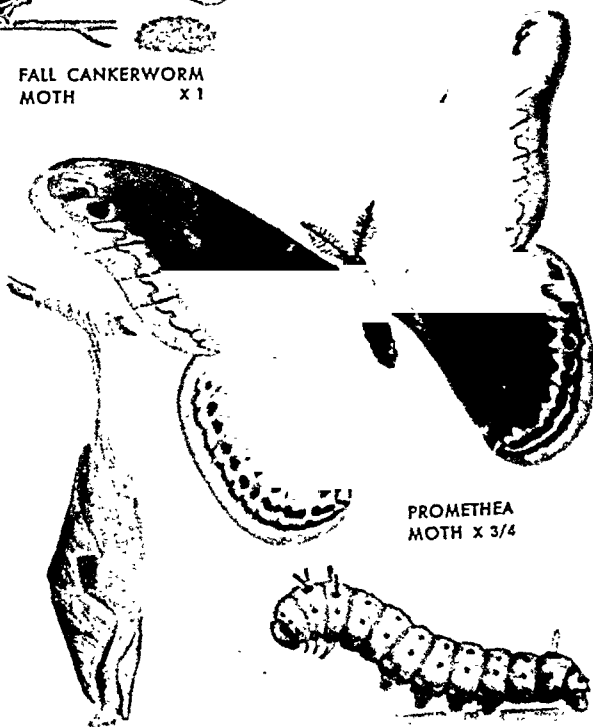
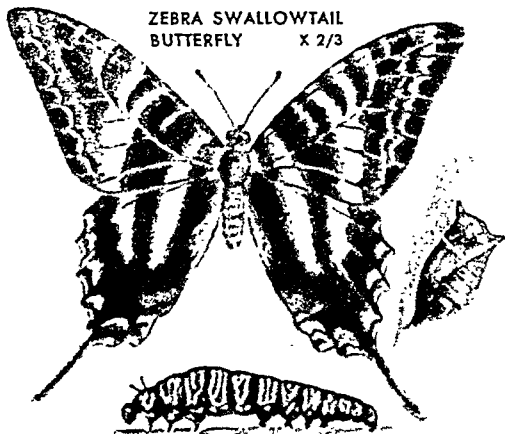
GREAT PURPLE
HAIRSTREAK
BUTTERFLY x 1



FALL CANKERWORM
MOTH x 1



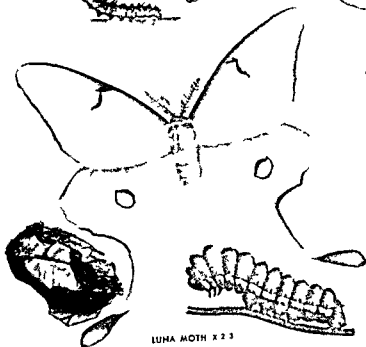
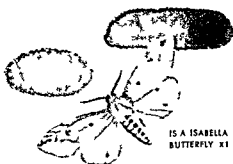
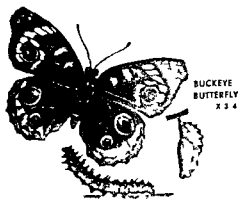
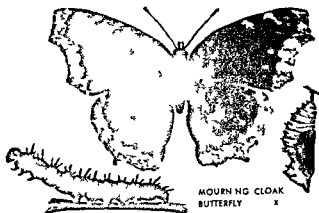
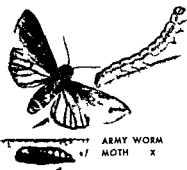
ZEBRA SWALLOWTAIL
BUTTERFLY x 2/3



PROMETHEA
MOTH x 3/4

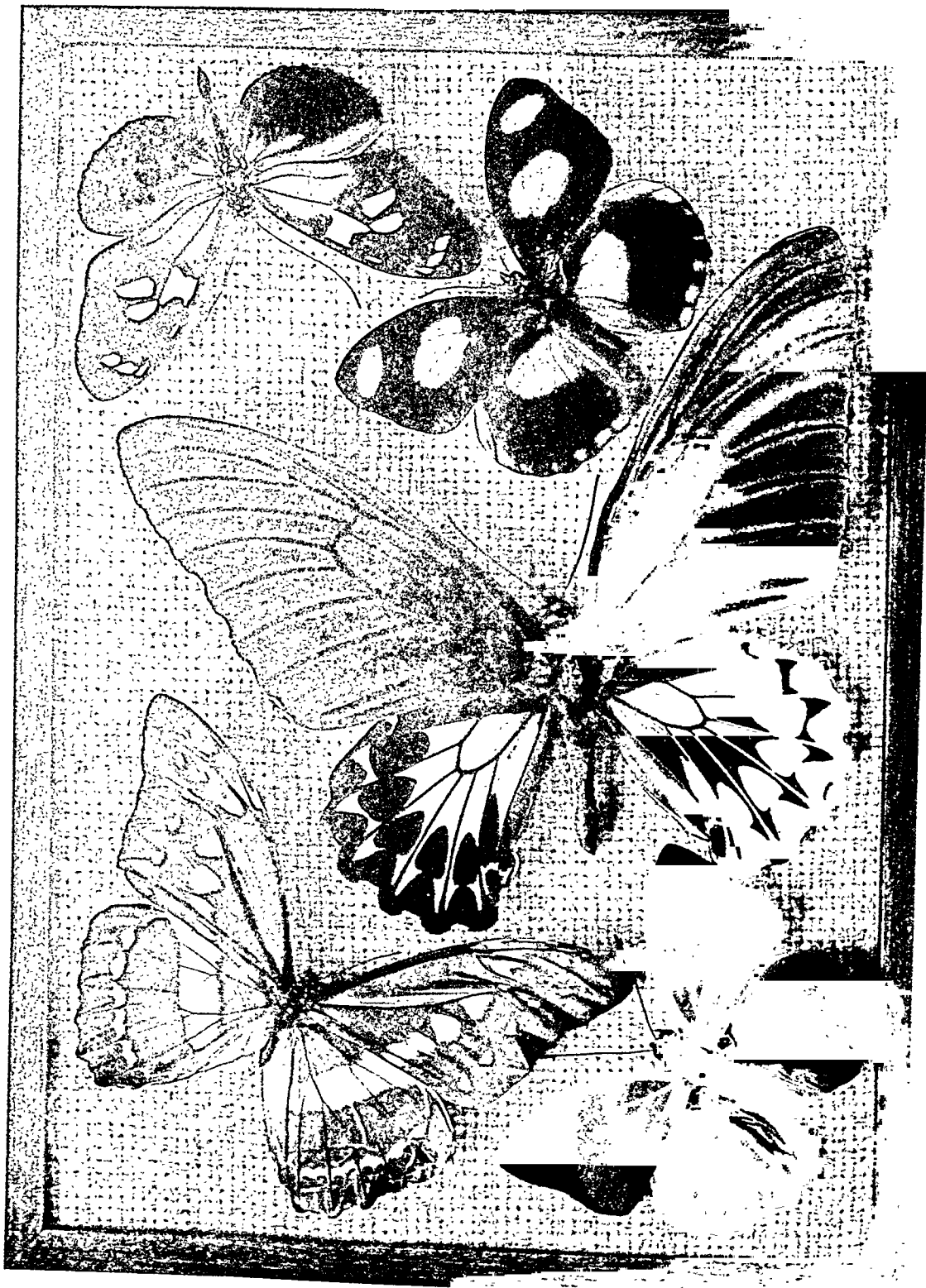
COMMON BUTTERFLIES AND MOTHS—THEIR CATERpillARS AND PUPAE

The pictures on these two pages show butterflies and moths, together with their caterpillars and their pupae. Some of them are better known as caterpillars than they are as adults. The fall cankerworm is one of the familiar "loopers" or "measuring worms." It is a serious pest, eating the foliage of shade and fruit trees. Adult butterflies and moths do not harm plants.



COMMON BUTTERFLIES AND MOTHS—THEIR CATERPILLARS AND PUPAE

The army worm caterpillar is one of the worst insect pests known of course. The caterpillar of the Isabella is the woolly bear, he grows into a glistening white butterfly soon after the first of the year. The mourning cloak butterfly is one of the earliest to appear in the spring. The luna moth caterpillar is a severe winter pest. There is a super on the amount of black on the wings of the Isabella butterfly. The caterpillar of the Isabella is a very common pest of the apple tree.



SOME GEMS AMONG THE BUTTERFLIES

These gorgeous butterflies are tropical specimens. Like many tropical species, most of them have no common names. The scientific names are: upper left, *Heliconius burneyi* from Peru and *Catonepela numilia* from the Amazon Valley; center, the "bird-winged" butterfly (*Ornithoptera vanedepolli*) of Sumatra; and bottom, *Morpho cypris* of Colombia and *Agria claudiens* of Brazil.

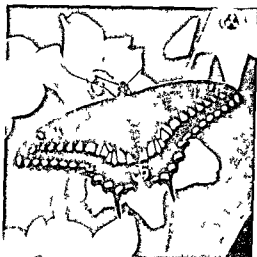
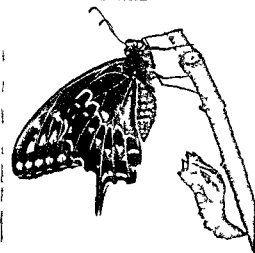
BIRTH OF A BLACK SWALLOWTAIL BUTTERFLY



The black swallowtail caterpillar (left) is green with black rings and yellow spots. It feeds on the leaves of carrots, parsley,

celery and related plants. When a ready to pupate (center), it spins a button of silk to which it attaches the rear end and a

silk-like hair, which supports the upper end of the body. The brown chrysalis (right) has an odd two-pronged head.



Working out of the chrysalis is a long and difficult task. The butterfly has climbed away from the old case and has pumped air into the veins of the wings, now no longer crumpled.

The butterfly has fluttered to some narcissus blossoms. It has a wingspread of $3\frac{1}{2}$ to 4 inches. It is glossy black with two rows of yellow spots. Between the rows are blue scales.

fully developed mouth parts and do not feed at all. Soon after they become adult insects they mate, lay their eggs, and then die.

As the adults visit the flowers in search of nectar, they rub against the stamens and pistils and so help in the process of pollination. The pronuba moth, which pollinates the desert yucca, is particularly interesting in this respect (see Yucca).

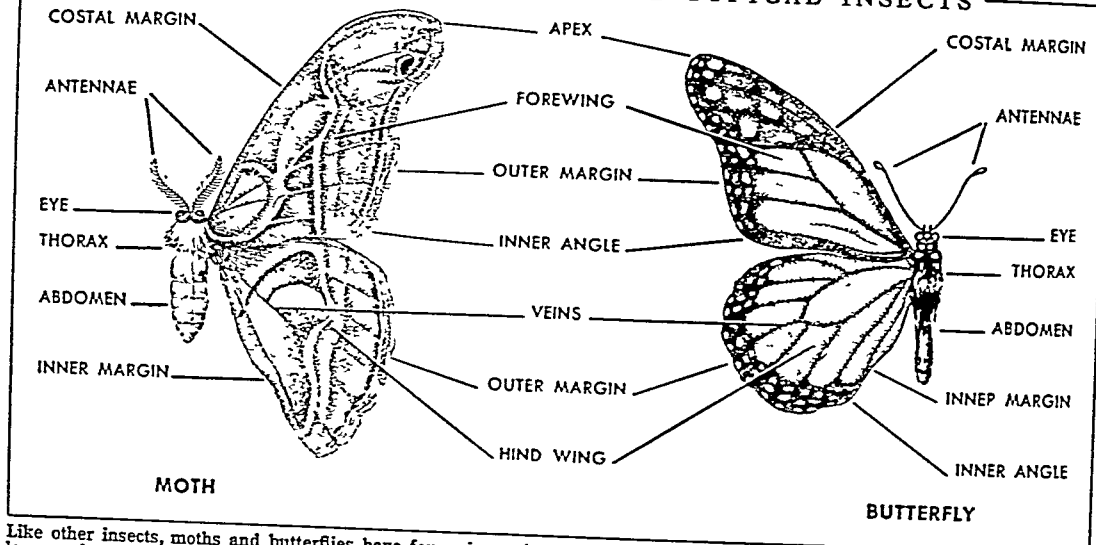
The Life Cycle—Metamorphosis

Butterflies and moths go through a life history known as complete metamorphosis. The female lays a great many eggs. From these hatch tiny larvae called caterpillars (see Caterpillars). The caterpillars eat greedily. At this time of their lives they become serious pests for many of them devour the food plants of man. The female always lays its eggs on the kind of plant that the caterpillars will use for food.

After several molts (shedding skin) the full grown caterpillar is ready to turn into a pupa. At this stage the butterflies and the moths differ. Butterflies spin a button of silk which adheres to a twig, leaf, or other solid support. They then cling to the button by a sharp spine at the end of the body and molt for the last time. As the old caterpillar skin peels off, there appears a naked pupa called a chrysalis. It is an insect in the making, encased in a tough, flexible shell.

Some moth caterpillars spin silken cases called cocoons in which they pass the pupal stage. Others burrow into the ground about six inches below the surface. There the caterpillar molts for the last time. The pupa is covered with a hard, dark, sticky substance which protects it from cold and moisture and from attacks of other insects.

MOTHS AND BUTTERFLIES ARE TYPICAL INSECTS



Like other insects, moths and butterflies have four wings, six legs, and a jointed body divided into three sections—head, thorax, and abdomen. The legs do not show in these drawings.

Moth antennae are feathery or, in some species, threadlike. Butterfly antennae always have clublike tips. The body of the moth is usually shorter and stouter than that of the butterfly.

The time spent in the chrysalis or cocoon varies with the kind of insect and with the time of year. It may be weeks or months. The pupa does not appear to be alive, but marvelous changes are taking place. Most of the organs and other tissues of the caterpillar break down, turning into a semiliquid. From this material are formed the wings, legs, and other parts of the adult. At last the adult is ready to leave the pupa case. If it is an earth-burrowing kind, the pupa, before it opens, wriggles to the surface by means of thrashing movements of the insect on the inside. After the insect has freed itself it is wet and its wings are soft and limp. It first climbs by its feet to some support, and slowly fans the wings to pump air into the veins. Gradually the wings expand and harden. In a few hours the adult is ready to fly and to seek a mate. Most adults live from four to six weeks. Some live only a few days, some as long as ten months.

Enemies and Defense

Butterflies and moths have many enemies. Birds are among the worst. Various kinds of flies and wasps lay their eggs on or in the bodies of the caterpillars, so the larvae dig in and feed on the tissues.

Both caterpillars and adults have ways of defending themselves. Stinging hairs and spines which may be poisonous protect some caterpillars. The "woolly bear" caterpillars are covered with a fuzz which makes them an unpleasant mouthful. "Frightfulness" is a defense of quite harmless creatures, such as the "hickory horned devil" with its red horns, the ugly tomato worm, and the caterpillar of the sphinx moth.

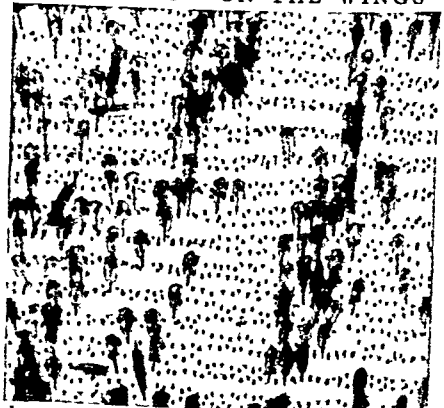
The monarch butterfly has a foul taste and odor which birds have learned to avoid. The tasty little viceroy butterfly looks exactly like the monarch, only smaller, and for this reason is also avoided. This is

defense by imitation. Many butterflies and moths at rest resemble dead leaves or the twigs and bark of trees (see Protective Coloration).

How the Winter Is Passed

Moths and butterflies may spend the winter in any stage of their lives. Bagworms hibernate as eggs. The eggs are in cocoonlike silken bags about two inches long, hung from the tips of branches. Gypsy moths winter as eggs attached in masses to a piece of wood and covered with scales from the female's body. Viceroy butterflies winter as caterpillars inside a nest made of a rolled leaf fastened to a twig. The caterpillars of the Baltimore butterfly spin a silken tent on top of their food plant and pass the winter within it. The cattail moth winters as a caterpillar inside cattail stalks. The codlin caterpillar burrows into an

"MOSAICS" ON THE WINGS



The wings of butterflies and moths are covered with scales as fine as dust. The scales give the wing its color and pattern. This highly magnified picture shows how they are set into the wing.

apple and the corn borer caterpillar into an old corn stalk

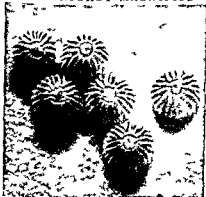
Pupae are well protected from winter cold by silken cocoons or hard thick cases. The cecropia, promethia and polyphemus moths winter in their cocoons. The red admiral butterfly hibernates as an adult in hollow logs. The adult mourning cloak butterfly seeks any shelter.

Though the great majority of these insects pass the winter in a resting state, some migrate southward. Great numbers of monarch butterflies are seen flying in the autumn. Some scientists believe that these are dispersal movements or simply a scattering of large populations. There is little evidence of a return flight to the north except possibly a few battered individuals. It seems certain that the following year's population is built up chiefly by monarch butterflies that remained through the winter.

Butterflies and Moths As a Hobby

Making a collection of butterflies and moths carefully mounted and accurately labeled is a fine hobby. It often leads to a broader study of insect life. (For pictures of collecting equipment and instructions on how to find specimens, mount and label them, see Insects.) It is extremely interesting to raise these insects from eggs and observe their life history. The abundant monarch butterfly is a good species to start with. Any weedy field with milkweed growing in it produces eggs and caterpillars. They are to be found on the under side of the leaves.

EGGS HIGHLY MAGNIFIED



The eggs of butterflies and moths as seen under the microscope have beautiful shapes and patterns. The female always lays them on the kind of plant that the larvae will require for food.

THE FACE OF A BUTTERFLY



This view of a butterfly's face shows the big compound eye and the mouth—a long sucking tube which curls up like a spring when it is not in use.

Do not disturb eggs or caterpillar, but pick the plant to which they are attached. Place the plant in a can filled with water to keep the milkweed fresh. Wire such as florists use will hold the weed upright. As the milkweed begins to wither, replace it with a fresh leafy stalk and let the caterpillar crawl onto it. Monarchs will not eat anything but milkweed, so do not experiment with some other plant.

After five molts the caterpillar reaches a length of about two inches and is ready to pupate. Now you must take care that it does not escape. In nature it will leave the milkweed and crawl to some high support. Strip off the lower leaves of the plant so that they do not form a bridge across the can or cover the can and the plant with a wire screen.

On a rib or stem of the plant or on the screen itself, the caterpillar begins to spin its silk button. Through a magnifying glass you can see the silk issuing from spinnerets in the head. When the button is completed, the caterpillar turns around, attaches the hooks at the end of the body to the silk, and then gradually releases its hold until it is hanging free upside down. Several hours elapse. When the long antennae at the head end become limp and shriveled, the caterpillar is ready to turn into a pupa. This is a thrilling thing to see. Some time before the old skin is ready to split open, the caterpillar begins

to swing and jerk. Suddenly at the top of the head the skin opens, and with thrashing movements the insect rolls it up toward the silk button. What is revealed is a beautiful case of jade green studded with golden dots. The pupa case twitches for about two hours, meanwhile shrinking in size. Finally it becomes still. Pupation is completed.

In about two weeks the pupa begins to turn dark. When it is black and transparent, the case opens and the butterfly pulls itself free. Now if you wish to breed monarchs you must confine your adult to a cage and provide it with a mate. It must have sugared water for nourishment and more milkweed on which the female may lay its eggs. Perhaps more satisfying is to set it free at an open window. As it flies away you may know that the delicate creature you have watched develop from a tiny egg will migrate perhaps thousands of miles with others of its kind.

Moths as Pests

Adult butterflies and moths do no economic damage. The caterpillars of most butterflies are also harmless. Moth caterpillars, however, cause enormous losses in food plants, fruit, forest, and shade trees, clothing and household goods. Most of them are better known as "worms" than they are as adult moths (see Army Worm; Cankerworm; Cutworm).

Familiar to all housewives are the clothes moths. Two kinds are common. The case-making moth (*Tinea pellionella*) is so-called because the caterpillar spins a shelter case of silk and bits of the material on which it is feeding. The webbing clothes moth (*Tineola biselliella*), the most abundant and injurious species, spins silky webs as it moves over a piece of material. A third kind, the tapestry moth (*Trichophaga tapetzel*), is rare in the United States.

The adult moths, or "millers," as they are often called, that dance around a light in the house are probably harmless. The clothes moth stays in dark places and flies very little. The adult has imperfect mouth parts. It does not feed at all and so does no direct harm to fabrics. The female begins to lay eggs, however, before it is a day old, and lays about 100 in the 7 to 14 days of its life.

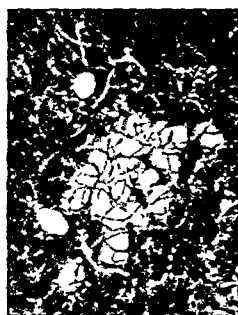
The soft, white eggs are laid loosely upon the nap of the material on which the larvae are to feed. They are easily dislodged and crushed, so that anything which is regularly brushed or shaken does not become moth infested. The eggs hatch in warm weather in from four to eight days. In colder weather, hatching may take as long as three weeks.

The larvae eat furiously for about 40 days before turning into pupae. The pupa stage takes 8 to 10 days in warm weather, and 3 or 4 weeks in the winter in a heated building. Eggs, larvae, and pupae are easily killed at low temperatures.

The United States Bureau of Entomology and Plant Quarantine makes the following recommendations for moth protection:

1. Frequent cleaning by brushing, vacuum sweeping, beating, shaking, and hanging in the sun.
2. Thorough cleaning before summer storage.

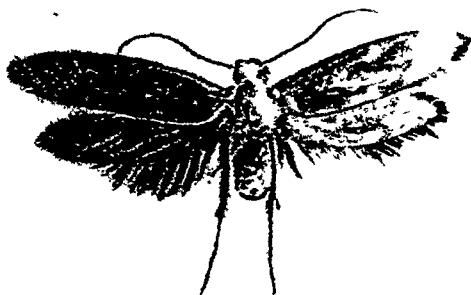
THE WEBBING CLOTHES MOTH



The webbing clothes moth lays its eggs (left) in wool, fur, hair, feathers, and all fabrics made from them. From an egg a white larva hatches (right). At full growth it is about half an inch long.



About 40 days after hatching, the larva spins a silk cocoon. The picture shows the pupa lying inside the cocoon, which is cut open.



The pupa stage lasts 8 to 10 days in warm weather. The adult moth is buff colored, with a wing expanse of about half an inch.

3. Tight packaging. Specially treated cedar or tar bags are of no value if moths are already present in the article or if there is the smallest opening into which the female can crawl to lay eggs.

4. Crystalline substances, chiefly naphthalene, para-dichlorobenzene, and gum camphor, are of value only if used in sufficient quantity and in tightly closed containers, such as trunks with tight-fitting lids and closets with sealed doors. Closets in daily use cannot be protected with these crystals. The vapors easily escape, and moths are not discouraged by odors alone. The fumes must be strong enough to kill them.

5. Cold storage for valuable articles, such as furs.

6 Use of 'mothproof' fabrics impregnated with chemicals during the dyeing stage

7 Spraying nonwashable articles with DDT or silicofluoride

8 Use of new chemicals such as EQ-53 which make it possible to mothproof wools when washing them

How They Are Classified

Scientists divide the order *Lepidoptera* (scale wings) into two suborders *Rhopalocera* the butterflies and *Heterocera* the moths. The ending *cera* means horn and refers to the antennae. *Rhopalocera* means club-shaped antennae. *Heterocera* means otherwise-shaped antennae.

The butterflies are divided into the *Hesperioidea* or skippers and the *Papilionoidea* or true butterflies. The skippers are so named because of the erratic way they dart about close to the ground. They are seldom more than one and a half inches across the wings. Their antennae are thickened at the ends with a short hooked tip but not knobbed. At rest the forewings are held vertically while the hind ones are extended horizontally. The body is stout like the moths. The pupa state is spent in an incomplete cocoon made of leaves fastened together and lined with silk. The skippers in general have more features in common with moths than with butterflies and may be an intermediate form between the two.

The true butterflies are divided into several families. The *Papilionidae* includes the swallowtail, the largest of the American butterflies. The family *Pieridae* includes the only butterflies injurious to plants. The cabbage butterfly was introduced from Europe in the 19th century. Its larva is a serious pest.

The *Nymphalidae* also called brush footed butterflies have small useless brushlike front feet usually

erect folded against the body. Best known in this family is the monarch butterfly. Other members are the fritillaries, crescent spots, mourning cloak, red admiral, painted lady, buckeye and viceroys.

In the family *Lycaenidae* are the small brightly colored blues, coppers and hairstreaks. The family *Riodinidae* comprises the metal marks, most of them southern and western species.

The *Heterocera* or moths are also divided into many families. The giant silkworm moths (*Saturniidae*) include the oriental silkworm and the lovely luna, cecropia, promethes and polyphemus moths. The large hawk moths also called sphinx moths (*Sphingidae*) are often mistaken for hummingbirds. They are about the same size and hover above flowers in the same way. Unlike most moths they fly about in sunlight. **BUTTERNUT** This native American tree is also called the white walnut. It is common in eastern United States except the southern coastal plains. The butternut is a medium-sized tree 40 to 60 feet high with a diameter of one to two feet. It often has a short trunk with numerous spreading branches. The bark is light gray and is divided into flat ridges. In older trees the ridges become closer and deeper with a somewhat diamond shaped pattern.

Like its relative the black walnut it has a compound leaf 15 to 30 inches long with 11 to 17 leaflets each 3 to 4 inches long. The sweet oily nut of delicious flavor is enclosed in a thin oblong-shaped husk about an inch in diameter. The wood of the butternut is beautifully grained and light in color. It is used in furniture making. A brown dye was once produced from the bark and the husks of the nuts. The dried inner bark of the roots has medicinal uses. The scientific name is *Juglans cinerea*.

BUTTONS—ORNAMENTS and FASTENINGS Through the Ages

BUTTONS To fasten and ornament the clothing of the American people billions of buttons are manufactured every year. Buttons have been used since ancient times. In the tombs of Egypt and of Mycenae in Greece have been found buttons of gold, glass and earthenware from 2,500 to 4,000 years old. They were used only as ornaments. Prehistoric peoples held their garments in place with thorns and with cords made from animal sinews. Later loose flowing robes were fastened with a girdle or a pin.

In the 15th or 16th century someone discovered that a loop slipped over a button or a button pushed through a slit in the cloth made a better fastener for the close-fitting garments that were coming into style. For some time however the chief use continued to be ornamental. King Francis I of France had 13,600 gold buttons on a single coat. King Louis XIV of France spent the equivalent of \$600,000 on jeweled buttons including a diamond-studded set valued at \$120,000. People wishing to dress in the extreme of fashion spent extravagant sums on buttons without regard to their usefulness. One of the costliest in the London street traders known as coster-

mongers still wear a costume covered with pearl buttons. Some religious bodies such as the strict Menonites in Pennsylvania and elsewhere forbid the wearing of buttons as a worldly display. Only hooks and eyes may be used.

Some buttons which today seem ornamental once had a practical use. The buttons on men's coat sleeves were originally used to fasten the cuffs back over the long lace frills of the shirt sleeves. Those at the back of the frock coat were used to fasten up the long skirts of the coat when the man was riding horseback. Since the Middle Ages the buttons on a man's garments have been sewed on the right side. Thus he could quickly unbutton the coat with his left hand and at the same time pull out his sword or other weapon with his right hand. The fastenings on women's clothing are sewed on the left side.

Ornamental buttons are again becoming popular in women's clothing. Elaborate fashion buttons are designed by highly paid artists and by Parisian costume designers. Matching earrings and hat ornaments are popular as are buttons dyed and designed to match the fabrics on which they are fastened.

Buttons are also used to indicate membership in a club, a society, or a trade union. This practice too has its origins in antiquity. Chinese officials long advertised their rank by the color and material of the buttons worn in their hats. During presidential campaigns people show their political preference by wearing a button inscribed with a picture of the candidate and the campaign slogan.

Early buttons were made by skilled craftsmen who designed and fashioned one at a time. As a result they were expensive and were not carelessly discarded with worn-out garments. They were used again and again and were bequeathed from one generation to the next. A popular hobby today is collecting these old buttons, many of them works of art with interesting histories. The National Button Society sponsors an annual exhibition of collections and awards prizes. Some collectors specialize in pewter, porcelain, enamel, bone, silver, or gold buttons. Others gather animal, flower, insect, ship, or historical subjects. Buttons made by Josiah Wedgwood for 18th-century costumes, buttons depicting fables and fairy tales, portrait heads of famous women, Biblical scenes, and scenes from the grand operas are the subject matter of various specialized collections.

Button making today is a machine operation. Some 12 billion, or 90 million gross, of buttons are produced every year, with a total value of about 30 million dollars. A wide variety of materials are used. About 80 per cent of the buttons produced in the United States are made of plastics, which have the advantage of superior flexibility and adaptability to intricate designs. Casein, made from skim milk, is used for buttons in which color and fine appearance are most important. They do not wear well with repeated and heavy laundering. Practically all staple buttons,

the design of which does not change from year to year, are made of urea. Urea buttons are inexpensive and durable. Melamine buttons are a cheap imitation of pearl buttons, but they are stronger and stand up better under washing. They are used especially on men's shirts. (See also Plastics.)

"Pearl" buttons are made of mussel shells from the Mississippi River. Muscatine, Iowa, is the center of production. The shells are soaked in vats of water for several days. Then while they are held in specially designed tongs, they are cut into blanks by a cylindrical steel saw. The blanks are sent to the finishing plant where they are turned, polished, and dyed and holes are bored in them.

New York and New Jersey also produce some freshwater pearl buttons, but these states are the major centers for the more expensive ocean pearl buttons. They are made from the white shell of West Australia, the yellow shell of Manila, and the black shell of Tahiti. Machines cut out the button pieces from the shell with tubular saws, split them into disks, drill the holes, and smooth and polish them—all with practically no hand labor.

Another important material is vegetable ivory. This is the nut of the *tagua* (also called *corozo*) palm, which grows in the jungles of Ecuador, Colombia, and Panama. Large clusters of 15 to 100 nuts, enclosed in tough, woody burs, grow close to the stumpy trunk of the tree. The clusters may be as large as a man's head. Each nut is about the size of a hen's egg.

Laborers in the forests cut down the burs and chop them open with a machete. The nuts are carried on mule back and river raft to export centers on the coast. They may be shipped to the button manufacturers as whole nuts or they may first be sawed into flat slices. The slices are run through sizing machines and then

TAGUA NUTS, OR VEGETABLE IVORY, FROM WHICH BUTTONS ARE MADE



Tagua nuts grow in large burs on a jungle palm tree native to Panama, Colombia, and Ecuador. This bur (left) has been cut open to show the nuts on the inside. It is as large as the boy's head. The nuts are cut into thin slices (center). Then they are run through sizing machines (right) and shoveled into burlap bags to be shipped to the button manufacturers.

THE MAKING OF PLASTIC BUTTONS



The manufacture of plastic buttons starts with drawings and blueprints of the designs. These go to the machine shop.



The patterns traced on steel sheets are multiplied. A drill makes holes in a sheet in which the dies have been cast.



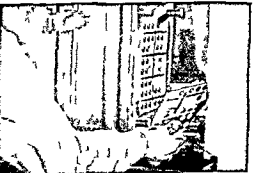
The buttons are made of pellets of urea-formaldehyde compound. Here the raw material is being fed into the molding machine.



The finished pellets from which the buttons are to be made are being swept from the molding machine onto a loading tray.



The plastic pellets are placed on the compression machine to receive the imprint of the dies on the steel plates above them.



An operator removes the plates of buttons from the compression machine. Then they undergo a series of finishing operations.

WORKS OF ART FROM BUTTON COLLECTIONS



A popular hobby is collecting buttons. Many collectors specialize in certain subjects. Here are examples of children's games and

poems ("the cow jumped over the moon"), toys, animals, flowers, insects, portraits, and miniature paintings set in jewels.

shipped in loose-mesh bags. At the factory they are shaped and dyed. Vegetable ivory absorbs coloring matter readily and so can be dyed to match or contrast with various materials. Most of the output is used on suits and overcoats. The chief manufacturing centers for vegetable ivory buttons are Rochester and Brooklyn, N. Y., Newark, N. J., and Springfield, Mass. About 6,000 tons of tagua nuts are imported from Ecuador alone every year. Some Italian button manufacturers use the nut of the *palma dum* of Egypt as a substitute for tagua nuts. Most of the output is bought by the clothing trade for use on men's and boys' coats, vests, trousers, and overcoats and on women's suits and coats.

A large proportion of the manufacturers of metal buttons receive their metal prepared in sheets ready for cutting into blanks. Power presses cut blanks for fronts and backs. Patterns are then stamped on them and the buttons are assembled and polished. There are also cast-metal buttons made by pouring molten metal into molds of different sizes and designs. Various patent buttons are made which do not have to be sewed on. They are usually in two pieces, with a shank on one piece which goes through the cloth and fastens by means of a spring clip in the other half on the other side of the cloth.

Bone buttons are made from the shin bones of cattle. In the United States the packing houses

furnish the great bulk of the material used in their manufacture. They are used mainly for underwear and children's clothing. Cloth and silk buttons are made by covering wooden forms or metal disks. The work of covering is now done by machinery.

Glass buttons are made in infinite variety and color, and there is no limit to the patterns that can be produced. They are chiefly of the novelty type, and the nearest to a standard is the jet glass button. Bohemia has been the home of the glass-button industry for many generations, and the skilled workmen guard the secrets of the trade, which have been handed down from father to son ever since the industry was started.

The ordinary shoe button is made of papier-mâché. In the process of manufacture the buttons are saturated with linseed oil or amber varnish to give greater firmness; they are then dried, again coated with hot amber varnish, and baked. In finishing they are polished with pumice, given the desired coating of color, dried and again coated; and this process is repeated for three or more coats.

BUZZARD. In the United States, "buzzard" is another word for the vulture, a large bird of prey (see Vulture). The word is also popularly applied to various hawks of the genus *Buteo* and to other birds of prey, as the kites, ospreys, and harriers. The common buzzard of Europe is a hawk, *Buteo buteo*.

BYRD RICHARD EVELYN (born 1888) A boy of 12 set out from Richmond Va. in 1901 and went around the world alone. By 1935 he had flown over the North and the South Poles and had mapped some 450,000 square miles of hitherto unknown lands in Antarctica.

This explorer, son and namesake of Richard Evelyn Byrd, an attorney, was born in Winchester Va. He was graduated from the Naval Academy in 1912. He trained as a World War air pilot in 1917 and commanded the United States Naval Aviation Force in Canada from July 1918 until the Armistice.

In 1926 Byrd went as flight commander with the Navy MacMillan expedition to Greenland. On May 9, 1926, with Floyd Bennett as pilot, he achieved the first flight ever made by airplane to the North Pole.

In 1927 Byrd, with three friends, flew 4,200 miles across the Atlantic in 43 hours. The monoplane *America* on July 1 was forced down upon the sea off France at Ver-sur-Mer, the very spot where Byrd's Norman ancestor, one LeBri, had landed in 1540.

But it was in Antarctica that Byrd proved himself to be one of the great explorers of modern times. In two expeditions, planned with infinite study, he and his men uncovered more secrets of scientific value than had all previous explorers of Antarctica (see Antarctic Continent). His methods and discoveries are described in the article *Polar Exploration*.

On the expedition of 1928-30, he claimed a vast territory for the United States, naming it Marie Byrd Land for his wife. Piloted by Bernt Balchen on Nov. 28-29, 1929, he made the first airplane flight to the South Pole. He was made rear admiral in 1930.

In 1933-35 Byrd added some 200,000 square miles to American claims, but nearly lost his life. To study weather, he spent 4½ months, March 28-Aug. 11, 1934, alone in a hut 123 miles south of his base, Little America, on the Ross Sea. Rescuers found him poisoned by carbon monoxide gas from a stove. He made a third expedition to the Antarctic in 1939-41.

Byrd won the Legion of Merit and a special citation for confidential work in the second World War. He returned to the Antarctic as head of a navy expedition in 1946-47. The party made aerial surveys and tested polar equipment. Byrd flew over the South Pole for the second time on Feb. 16, 1947.

Thousands have shared Byrd's adventures in his lectures and motion pictures. His books include *Skyward* (1928), *Little America* (1930), *Discovery* (1935), *Exploring with Byrd* (1937), *Alone* (1938), *BYRON GEORGE GORDON LORD* (1789-1824).

The most talked-of man of his day was George Gordon Lord Byron. His dark, handsome face, his riotous living and many love affairs and his tragic death at the age of 36 made him a romantic, fascinating figure to his fellow Englishmen. Today he is largely forgotten as a romantic adventurer but well remembered as a great poet.

Byron was born Jan. 22, 1788, in London. He got off to a bad start. His great uncle, from whom he inherited the title, was known as "ficked" Lord Byron, and his father, an army officer, was called

mad Jack. Byron very likely there was a strain of nervous instability that amounted almost to insanity in the family. The boy was born with a lame foot and he was naturally sensitive about it all his life. When he was three his father died, leaving the small family nearly penniless.

Byron succeeded to the title of baron when he was ten. The honor brought with it a half ruined estate, Newstead, and a moderate income. He received his preparatory school education at Harrow, and at 17 he entered Cambridge University. Through his school years he was a poor student, reading much literature but caring little for other subjects. Determined to overcome his physical handicap, he became a good rider, swimmer, boxer and marksman. He was inclined to plumpness and throughout his life he doted strenuously to keep a slim waistline. Byron thus developed himself physically, but he never learned to govern his emotions, especially his furious temper.

His first poetry, published when he was 19, was a volume called *Hours of Idleness*. It was attacked and for good reason by the *Edinburgh Review*. Byron rose to the occasion with a vigorous satire on his critics called *English Bards and Scotch Reviewers*. His travels in Europe and the Middle East inspired his first long poem, *Childe Harold's Pilgrimage*, the first two sections or cantos of which were published in 1812. With its publication in his own words, he awoke one morning to find himself famous. Women sought him out and young men copied his open collar and flowing cravat.

In 1815 he married Anne Milbanke. They had one daughter, Augusta Ada, but they separated soon after the child was born. Society and the public reviled unfavorably to Byron's often scandalous conduct, and in a fit of temper he left England for Italy. There he wrote additional cantos for *Childe Harold*. Manfred, a verse play, and *Don Juan*, a long half-romantic, half-humorous poetic version of the old Spanish story, Byron had long sought a political cause for which he could work. He found it in Greece's struggle to free itself from Turkish rule. He went to Greece and began helping to organize the revolt. At Missolonghi he died of a fever on April 18, 1824.

BYZANTINE EMPIRE The Byzantine Empire was the strange oriental afterglow of the sinking Roman Empire. Too vast to be governed and defended from a single capital, the empire gradually split into a western half and an eastern half. As the west declined, the east grew stronger until finally in A.D. 330 Constantine the Great decided to remove his capital from Rome. He did this partly to obtain a better base for defense against attacks from Asiatic foes, partly because Rome was the stronghold of the ancient pagan faith. Constantine had vision enough to see that the future lay with the new Christian religion. (See *Constantine*.)

For his capital, Constantine chose Byzantium, which he rebuilt fortified and renamed Constantinople. He said that his choice of the city was revealed

to him in a dream. It proved a most practical dream.

The narrow straits of the Dardanelles could be rendered impassable to a hostile fleet, and the forts of the landward side were built so strong that a small force could hold them against a very large one. Weak, idle, and dissolute as the people became, their city was so strong that the Byzantine, or Eastern, Empire survived for a thousand years after Constantine, long after the Western Roman Empire had crumbled away. Roman law and many of the ancient Roman traditions persisted in the East, though Latin soon gave place to Greek as the popular tongue, and life and art became more and more oriental in tone.

The World's Debt to the Byzantines

It is precisely for its preservation of the civilization of Rome and Greece, and for its service as a bulwark against invasion from Asia, that the Byzantine Empire did a work of incalculable value. To be sure, the scholars of Constantinople were so dazzled by the wealth of learning they had inherited that they did little with it except study it and compile books of extracts or summaries.

Most useful of these compilations was the famous Justinian Code of Roman law, made by scholars under the emperor Justinian, who with his beautiful actress-wife, Theodora, ruled the Byzantine Empire from 527 to 565, the period of its greatest glory. (See Justinian.) At this time the empire extended from southern Spain to the valley of the Tigris and Euphrates, and from the Danube River to upper Egypt.

The wise Justinian was a contrast to the foolish, pleasure-craving, splendor-intoxicated people he ruled. Yet how they must have loved their gorgeous and lively city! In its streets guards with golden spear-heads jostled a cosmopolitan crowd—Bulgarians in baggy trousers and big turbans; cruel, cat-faced Huns; and Persians nodding their tall sheepskin caps. Beautiful things from many lands filled the shops: silk, purple cloth and gold from Greece; spices, drugs, and precious stones from India; silks from Arabia; fur, honey, and wax from Russia; and the beautiful jewelry, gold brocades, carved ivories, and rich embroideries of Constantinople itself.

In Justinian's glowing church of Santa Sophia the sunlight poured down from 40 windows of the great dome, washing in golden light the gold mosaics with their bright-colored saints, the columns of jasper, marble, alabaster, and porphyry, and the designs of mother-of-pearl. Court life was ceremonious and gorgeous. A visitor to Constantine VII in 948 found the emperor seated on his throne before a golden plane-tree full of artificial birds which burst into song, while two golden lions on each side of the throne began to roar. The startled visitor touched the floor thrice with his forehead, and arose to find that the emperor, throne and all, had been hoisted to the roof!

Heart of the life of Constantinople, however, was the Hippodrome, where 30,000 people sat under awn-

ings of silk and purple to watch the chariot races and to enjoy the triumphal processions of victorious generals, who distributed to the crowd loot taken from the Vandals—golden girdles, silver vases, gems and dishes and garments. The Empress Theodora in her youth performed in this circus. A one-eyed yellow dog was equally famous as an entertainer, since he could sort out a pile of rings and return each to its owner. The childish mobs divided so hotly in their enthusiasm for rival groups of charioteers that in their strife they once burned the best part of the city and nearly cost Justinian his throne.

Yet this was the nation which led the world in art, so that its bulbous domes and glittering mosaics are to be seen in Santa Maria Maggiore in Rome, in San Vitale and San Apollinari in Ravenna, in the mosque of Cordova, Spain, and in the famous St. Mark's Cathedral in Venice. The latter contains one of the most remarkable examples of the goldsmith's art in the world, the Pala d'Oro, a great Byzantine reredos with 24 figures in enamel against a background of gold and big uncut precious stones.

Sacred Images and the Iconoclasts

One feature of Byzantine art is its lack of statuary. The early Christians disapproved of it because they feared the Christian church would fall into the old pagan worship of images. The Arabs, always in close touch with the Byzantine world, held the same views. After a time, however, the clever hands of Byzantine artists were carving ivory bas-reliefs of the saints, or making icons—gilded and painted religious pictures. The emperor Leo III in 726 began a campaign to abolish these images, and his adherents, who smashed the sacred pictures, were called "iconoclasts" or image-breakers. So serious was the strife over images that it was an important factor in bringing about the division between the east and west branches of the church. (See Church, Christian.)

Constantinople grew more and more oriental in tastes and sympathies, gayer, and also weaker. When the Crusaders came there at the close of the 11th century, they were amazed to find a city of a million people, with paved and lighted streets, great parks, hospitals, theaters, efficient police, fine palaces, and excellent schools.


Yet it was the Fourth Crusade which first brought ruin to Constantinople. In 1204 the Crusaders, at the instance of the jealous Venetians, captured and looted the city. Many great art works of the past were destroyed, and the famous bronze horses were carried off to St. Mark's in Venice.

A ghost of the Byzantine Empire survived for a time, until in 1453 the fierce Ottoman Turks closed in on the doomed city of Constantinople, killed the emperor Constantine XIII, plundered, murdered, and took slaves. Since then (until 1923) the city has been the Turkish capital and the crescent has replaced the cross over Santa Sophia. (See Istanbul.)

THE EASY REFERENCE FACT-INDEX

GUIDE TO ALL VOLUMES FOR SUBJECTS
BEGINNING WITH

B

TO SAVE TIME
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*Numerous other lists and tables in the fields of geography, history
literature, science, mathematics and other departments of knowledge
will be found with their appropriate articles in the main text*

EDITOR'S NOTE

EVERY user of Compton's Pictured Encyclopedia should form the habit of *first* turning to the Fact-Index section at the end of each volume when in search of specific information. This index is a miniature work of reference in itself and will often give you directly the facts, dates, or definitions you seek. Even when you want full treatment of a subject, you will usually save time by finding in the index the exact page numbers for the desired material.

All page numbers are preceded by a letter of the alphabet, as A-23. The letter indicates the volume. If two or three page numbers are given for the topic you are seeking, the first indicates the more general and important treatment; the second and third point to additional information on other pages. Where necessary, subheadings follow the entry and tell you by guide words or phrases where the various aspects of the subject are treated.

The arrangement of subheadings is alphabetical, except in major historical entries. In these the chronological order is followed.

The pictures illustrating a specific subject are indicated by the word *picture* or *color picture* followed by a volume indicator and a page number. A picture reference is frequently intended to call attention to details in the text under the illustration as well as to the illustration itself. This picture-text, therefore, should always be carefully read. The pictures are usually on the same page as the text to which you are also referred; sometimes they are found in a different but related article which will add interest and information.

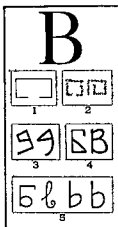
The pronunciations given are those preferred by the best and most recent authorities; alternative pronunciations are indicated where usage is divided.

In recent years hundreds of foreign geographical names have been changed, either officially or by custom. Both old and new names are given at the appropriate places in the alphabet.

Populations are those of the latest census or an official estimate when available if no census has been taken since World War II. Distances between points are map or air distances, not distances by railroad.

THE EASY REFERENCE FACT-INDEX

Rev. T. S. P. O. L.



OUR LETTER L probably started in Egyptian writing as a picture sign for house (1) Shortly after 2000 B.C. a Semitic people called the Semites adopted this picture as an alphabetic sign for the sound of b because the Semitic word *beth*, meaning house began with this sound

The Semitic sign was crudely made (2) but the Canaanitic Phoenician alphabet gave it a better shape with a tail (3) In Hebrew and probably in other Semitic languages the sign was called *beth*

When the Greeks learned to write from the Phoenicians they changed the name of the letter to *beta*. Later when they began to write from left to right instead of from right to left they turned the letter around. They also gave it graceful curves (4) The Romans took it in curved form into Latin and from Latin the capital letter came to us without change

Our present small b began to take shape in later Roman times when writers fell into the practice of omitting the upper loop of the capital or making it long and thin (5) By the 9th century the letter had its present form

NOTE—For the story of how alphabetic writing began and developed, see the articles Alphabet Writing

Baa Baa Black Sheep, story by Kip King K 45

Baader (ba dēr) Benedict Franz Xavier von (1781–1841) German philosopher and speculative theologian of Roman Catholic church born Munich practiced medicine and engineering professor theology University of Munich

Baal (bā a) Semitic name for a lord master or god B 1

Baalbek (bā bek) Lebanon village 35 mi n.w. of Damascus famous for splendid Roman ruins once finest of Syrian cities probably an early seat of Baal or sun god worship called Heliopolis by Greeks

Baalzebub See in Index Beelzebub

Baba (ba bā) Cape Turkish Baba Duran (ba ba bor-an) ancient Cape Lectum in n.w. Turkey west extremest point of mainland of Asia Minor and therefore of continent of Asia

Babaka or **Indel** a lemon L-162

Babassu (ba bā sū) nut hard shelled Brazilian nut valued for its oil obtained from a palm of the genus *Attalea* related to coconut N 317 palm picture S 273

Babbage (bā bā) Charles (1792–1871) English mathematician born near Teignmouth Devonshire England professor of mathematics Cambridge University 1829–39 invented a calculating machine to perform difficult computations but never completed it

Babbitt Irving (1865–1933) scholar and critic born Dayton Ohio professor of French literature at Harvard University 1912–33 foe of naturalism exponent of the classical formula of moderation and form a leader of the humanist movement in America

Babbitt Isaac (1799–1862) inventor born Taunton Mass made first Britannia ware (1824) in U.S. invented babbitt metal

Babbitt novel by Sinclair Lewis A 230d N 312 L 175

Babbitt metal a soft alloy of tin copper and antimony A 173

Babbling of baby C 240b–c

Babak Alphaeus improves piano P 249

Babcock Stephen Montfom (1843–

1931) educator and agricultural chemist born Bridgewater N.Y. ed. at Tufts College Cornell University and University of Göttingen Germany on faculty at Cornell and Wisconsin universities did notable work in chemistry of milk devised Babcock milk test which he gave to the world refusing to patent it for private gain

Babcock test D 2 W 166

Babel (bab el) Isaac Emswiler (born 1884) Puritan short story writer born in Odessa of Jewish family joined Coast Guard and wrote of his experiences in *Stories of the Peddler* R 255

Babel (bab el) Tower of built by Noah's descendants as safeguard against future floods during construction occurred the confusion of tongues (Gen xi) in Babylon B 5 picture B 6

Bah el Mandeb (bab el ma: dēb) (Arabic for gate of tears) a strait between Arabia and Africa at end of Red Sea 20 mi across named from danger of navigation maps A 285 A 46

Babenberg House of 1st Austrian dynasty (976–1246) A 496

Baber (ba bār) (1483–1530) founder of Mogul (Mongol) Empire in India M 346 I 67

Babe Ruth League in baseball B 70

Bales in the Wood an old ballad which describes two little children who were left in the woods to perish origin of ballad unknown

Bale the Blue Ox in Paul Bunyan tales B 107 picture I 198

Bal picture M 230

Balancing Anthony (1561–86) page to Mary Queen of Scots executed for conspiracy to murder Elizabeth

Babylonia (bā bī lō nē) or **Babylon** long tusked wild swine found on the island of Celebes

Babylon See in Index Bahai faith

Babel formerly Babeloth a trading town in Iran 12 mi from Caspian Sea pop. 36,590 rice cotton silk maps I 224 A 406

Baboon or dog headed monkey D 1–2, pictures B 1 M 351

Baboon range picture Z 362

Babrine (bā brī nē) (1st century A.D.) a tale of Aesop's fables A 30

Babson Roger Ward (born 1873) statistician born Gloucester Mass. founded statistical organization with branch offices in largest American cities nominated for U.S. president by Prohibition party 1940 (Eugene's Barometer) The Future Method of Investing Money A Business Man's Creed

Baby blue-eyes See in Index Nemo phila

Baby bonnet (*Cypraea testiculus*) snail shell color picture S 139a

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318 picture P 315, games P 319 picture P 319

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wearing B 3

weight B 3

Babyhood in child development C 240, pictures C 240b

Babylon (bā bī lō nē) capital of Babylonian on Euphrates River about 55 mi s.e. of Baghdad B 5 maps E 278b B 6 P 156 A 285

See also in Index Babylonian Alexander in A 149 canal C 108a

Hammurabi B 5 B 7–8 Hanging Gardens B 5 S 104 pictures E 9 S 108 paved streets L 160 sick treatment of H 429b

Babylonia ancient empire of Tigris Euphrates Valley including Chal

- dean Empire, or Second Babylonian Empire B-5-8, *maps* B-6, P-156, E-278b, *pictures* B-5-6b, *Reference Outline* A-240, 240a. *See also in Index* Sumerians
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- Babylonian captivity of Jews J-353, B-5
- of popes B-228, P-191, G-215
- Baby's breath, common garden flower; name correctly applied only to species of *Gypsophila* (*gip-sôf'i-lâ*); tiny white or pink flowers in loose clusters, small lance-shaped leaves
- how to plant, *table* G-16
- Bacalaos, also Bacalaos, name given to North America by the Cabots C-95a
- Bacchanalia (*bâl-a-nâ'i-a*), Roman festival celebrated in honor of Bacchus D-93
- similar Greek festival D-129
- Bacchantes (*bâ-kân'ts* or *ba-kân'tîz*), dancing women attending Bacchus D-93
- Bacchus (Greek Dionysus), Roman god of wine D-93, D-129. *See also in Index* Dionysus
- Bach (*bâk*), Johann Sebastian (1685-1750), German musician and composer B-8-10, *picture* B-10
- analysis of music M-461-2
- equal temperament advocate M-469
- music played by Mendelssohn M-171
- wrote for harpsichord and clavierchord P-248
- Bach, Karl Philipp Emanuel (1714-88), German musician, born Weimar; son of J. S. Bach; court musician to Frederick the Great, 1746-68; later at Hamburg; made use of harmonic color
- develops sonata M-462
- Bacharach, Germany, town on Rhine River 22 mi. s. of Coblenz; 13th-century ruins.
- Bachelder, John (1817-1906), inventor, born Weare, N. H.; made many improvements on sewing machine; S-117
- Bachelor, Irving (1859-1950), novelist, born Pierrepont, N. Y.; interpreted American life and character with sympathy and humor; also wrote historical fiction ('Eben Holden'; 'D'ri and I'; 'A Man for the Ages'; 'Silas Strong'; 'Cricket Heron'; 'The House of the Three Ganders'; 'The Master of Chaos').
- Bachelor (degree), academic distinction given by a college or university, usually after four years' study as undergraduate, common form is B A or A B (Bachelor of Arts), also given in divinity, medicine, law, science, philosophy, literature U-400
- origin U-404
- Bachelor's button, name for several garden plants *Centaurea cyanus* has blue pink, purple, or white flowers. Also called cornflower, ragged robin, and bluebottle
- Bacher (*ba'ker*), Robert Fox (born 1905), physicist, born Loudonville, Ohio expert on atomic spectra; with Los Alamos atomic bomb project 1943-45, director nuclear physics laboratory, Cornell University since 1945; member Atomic Energy Commission 1946-49.
- Bacillus (*ba-sil'us*) a genus of rod-shaped bacteria B-15
- Bacillus, plural bacilli (*ba-sil'i*), rod-shaped bacterium, *pictures* D-102, B-12-13
- Bactracin (*bâs-i-trâ'sin*), drug A-268, B-14
- Back Bay district, Boston, Mass. B-258
- Backbone. *See in Index* Spine
- Backbone Mountain, highest point in Maryland, 3360 ft., *map, inset* M-116
- Backgammon, game played by 2 persons each with 15 pieces or "men" on a board divided into 4 "tables," the moves being determined by dice-throws. The game is probably of Oriental origin; it was formerly called tables
- Backhaus (*bâk'hous*), Wilhelm (born 1884), German pianist, born Leipzig, Germany; professor Royal College of Music, Manchester, England 1905; brilliant concert pianist.
- Baciking. *See in Index* Architecture, *table of terms*
- Baciking, in fishing, *list* F-118g
- Bacikash, in fishing F-118c, *list* F-118g
- Back pressure, in electric circuits how generated in cells E-301
- Back pressure-arm lift method, of artificial respiration F-96, *pictures* F-95
- Backstitch, in sewing S-111
- Backstroke, swimming, *picture* S-472
- Backswimmer, a water bug W-64, 65, *picture* W-64
- Bacon, Francis, Baron Verulam and Viscount St. Albans (1561-1626), English philosopher, statesman, and writer B-10-11, D-377, *picture* B-11
- essays L-398
- founded empiricism P-204
- 'Novum Organum' S-61
- quoted E-377
- Shakespeare authorship controversy S-122, B-11
- Bacon, Henry (1866-1924), architect, born Watseka, Ill. ('Court of Four Seasons', Panama-Pacific Exposition Building, and many other notable buildings and memorials in classic Greek style)
- Lincoln Memorial, *picture* L-250
- Bacon, Josephine Dodge Daskam (born 1876), novelist and poet, born Stamford, Conn.; made study of child life ('Memoirs of a Baby'; 'Biography of a Boy'; 'Counterpoint'; 'Kathy'; 'The Root and the Flower').
- Bacon, Leonard (1867-1954), writer, born Solvay, N.Y.; taught English at University of California 1910-23; won Pulitzer prize for verse 1941 for 'Sunderland Capture and Other Poems'; translated 'Lusad' by Camoens (verse: 'Ulug Beg', 'The Furioso'; autobiography: 'Semi-Centennial').
- Bacon, Nathaniel (1647-76), leader of Bacon's Rebellion B-11
- Bacon, Peggy (born 1895), artist and writer, born Ridgefield, Conn.; well known as author and illustrator of books for children; favorite subjects are animals done in humorous fashion ('Lion-Hearted Kitten, and Other Stories').
- Bacon, Roger (1214?-94?), English monk, scientist, author B-11, *pictures* B-11, M-238h
- forerunner of modern chemists C-221
- knowledge of gunpowder G-232
- Bacon, a meat obtained from the side of the hog; flavored by smoking and curing; ranks next to butter in body fuel value: H-404, M-154
- Bacon's Rebellion B-11
- Bacteria (*bâk-têr'i-a*), a group of one-celled microscopic plants B-12-15, *pictures* B-12-15
- antibiotics A-266, 267-8, B-14
- antiseptics A-265-8, *pictures* A-266-8
- antitoxins A-268-9
- canning destroys F-219, 220
- cheese ripening C-206, 207
- classification L-225, *picture* L-224d
- cold checks activity A-266
- destruction by: bacteriophage B-13, P-305, *pictures* B-13; leucocytes B-208
- disease caused by D-101-4, B-13-14, *pictures* D-102
- enzymes E-389, B-13
- food poisoning H-303-4
- heat, resistance to B-13, 14
- identification B-15, *pictures* B-12
- industries based on B-14-15
- intestinal D-92, *diagram* D-91
- luminescence F-106, P-208
- nitrogen fixation. *See in Index* Nitrogen-fixing bacteria
- poisons generated P-341
- reproduction B-12
- respiration R-117
- scavengers B-13
- soil making B-13, S-226-9
- supersonic waves S-238
- test, centrifuge device for C-178
- ultraviolet rays destroy U-233
- vaccines V-433a, B, B-14
- war, use in B-14, A-382
- yeast making aided by Y-336-7
- Bactericide A-265, S-356
- Bacteriological warfare B-14, A-382
- Bacteriology, or microbiology B-12
- centrifuge device C-178
- Koch D-103, K-64
- Lister A-266
- Pasteur P-96, D-103
- Bacteriophage (*bâk-têr'i-ô-fâg*), a bacteria-destroying virus B-13, L-224a, b, P-305, *picture* B-13
- in plants P-305
- Bactra, Afghanistan. *See in Index* Balkh
- Bactria, ancient country (modern Balkh, Afghanistan) n. of Hindu Kush Mts.; famous for horses and camels; one of earliest homes of Aryans; conquered by Cyrus the Great and Alexander; kingdom later extended to n. India: *map* M-7
- Bactrian camel C-52-3, *pictures* C-52, Z-358
- Bad air, household hygiene H-304

Key: câpe, ât, fâr, fast, what, fâll, mé, yét, fêrn, thêre; îce, bit; rôw, wôn, fôr, nôt, dq; câre, bút, rîde, fûll, búrn; out;

Badajoz (ba da hoz) Spain his-
toric city on Guadiana River 5 mi
from Portuguese frontier pop
79 291 with suburbs taken by
French (1811) and recaptured by
British (1812) map E 425

Bad Fum Germany See in Index

Baden (ba den) former state of s.w.
Germany former grand duchy 8819
sq mi after World War II n part
incorporated into Württemberg

Baden s part became South Baden
(Südbaden) sometimes called
simply Baden

Black Forest B 203-4
Heidelberg H 330

Baden Baden Germany health resort
in South Baden at edge of Black
Forest pop 27 007 numerous min-
eral springs map G 88

Baden Powell (1859-1948) na-
tional vice president of Girl Guides
for many years author of *Hand-
book* important worker with Brit-
ish Red Cross G 113

Baden Powell Robert Stephenson
Smith first Baron Baden Powell
(1857-1941) British general served
in India Afghanistan and Africa
hero of Boer War (defense of Mafri-
king)

Baden Boy Scouts B 277-8
Baden Girl Scouts G 113

Baden Württemberg See in Index
Württemberg Baden

Badger animal of weasel family
B 15-16 pict re B 16

Badger building an old pig in which
dogs pulled badgers from barrels or
other artificial holes B 16

Badgering origin of word B 16

Badger state popular name for Wis-
consin W 179

Bad Ischl Austria See in Index
Ischl

Bad Lands areas in western U S
where shale and sandstone surface
has been eroded

Nebraska N 95
North Dakota N 282

South Dakota S 295-6 **Badlands**
National Monument N 30 map
N 18

Wyoming W 315

Badlands National Monument in
South Dakota N 30 map N 16

Bat minton game similar to lawn
tennis but played with shuttlecock
(birds) instead of tennis balls
played both indoors and outdoors
either with two or four players
singles (two player) court measures
44 by 17 ft doubles (four player)
court 44 by 20 ft net 3 ft high
at center named for estate of duke
of Beaufort Gloucester England
developed from game battledore and
shuttlecock See also in Index Bat
tledore and shuttlecock

Bad Nauheim Germany See in In-
dex Nauheim

Badoglio (ba do lyo) Pietro (born
1871) Italian marshal in World
War I victory of Ethiopia 1935
chief of general staff 1940 retired
after Greek campaign of 1941 suc-
ceeded Mussolini as premier in
1943 resigned in 1944 W 264

Badea See in Index Bado

Badeker (ba de ker) Karl (1801-
59) German publisher of guide
books for travelers

Darkland (bdk land) Leo Hendrik
(1863-1944) American chemist
born Ghent Belgium to U S 1889
became citizen 1897 invented Bak-
elite 1909

Bakelite I 201-2 patented table
I 189

Bair (ber) Karl Ernst von (1792-
78) Russian zoologist father of
embryology Z 361 E 338

Bair Max (born 1899) boxer born
Omaha Neb

heavyweight champion B 273 table
B 272

Bayer (bi er) Adolf von (1835-
1917) German chemist won Nobel
prize in chemistry (1905)

Bakes synthetic indigo I 113

Bat (ba) William (1884 1922) Eng-
lish navigator and Arctic explorer
discovered Baffin Bay 1815
named Venetia to Baffin Island said to
have been first to fix longitude at
sea by astronomical observation

Baffin Bay large gulf of n. North
America 86 mi by 280 mi maps
C 69 N 250 245

Baffin Island or **Baffin Land** Canada
island w of Greenland 49 180 sq
mi maps C 69 N 250 P 318
size comparative See in Index Is-
lands table

Bagnamo (ba gnay mo) Tangan-
ya k. Terr. terr. seaport and impor-
tant center of car and trade por-
tug. map A 47

Bagnana of **Wagana** Africa can be
B 159

Bagnase (ba gnay) sugar cane waste
S 444 448 pict re P 200

Bahadur Iraq See in Index Baghdad

Bagehot (ba g) Walter (1826 77)
English economist political philos-
opher and literary critic doted
Economist had wide influence
wrote in vigorous sparkling style
(Physics and Politics a novel
application of theory of evolution
on Lombard Street analysis of Eng-
lish credit system greatly influ-
enced banking The English Con-
stitution Literary Studies)

Bagalwal Indian name for game
bagwalwal L 32 81

Baghdad or **Bagdad** (bag dad) chief
city and capital of Iraq pop 63
049 350 mi n of Persian Gulf on
Tigris River B 16-17 I 225 maps
I 224 A 285 A 408

hauhi main Mosque picture I 225

Bagley William Chandler (1854-
1948) educator and writer born
Detroit Mich professor of educa-
tion 1917-40 emeritus after 1940
Teachers College Columbia U
activity prolific writer on education
and history (Craftsmanship in
Technique The Educative Pro-
cess) I 253-4

Bagnell Dam in Missouri across
Ozark River in Ozark Mts 120 mi
se of Kansas City Mo forms
Lake of the Ozarks one of largest
artificial lakes in world electric
power generated delivered mostly to
St Louis map M 312 picture M 322

Bagnold (bag nol) Ead (Lady
Jones) (born 1889) English novel-
ist born Rochester Eng and (The
Happy Foreigner National Vel-
vet The Loved and Envied)

Bagot (ba got) Sir Charles (1781-
1845) British statesman born
Rugby Staffordshire England
governor general of British North
America 1841-43 advocated re-
sponsible government

Rush Bagot Agreement (1817) C 89
G 184

Bagnipe a wind instrument B 17
pictures S 436 B 466

Bagratiyovsk (ba grai-i o i s) Russia
formerly Eysen (1809) Russia
city 25 mi se of Kalliningrad
scene of battle (1807) between the
French under Napoleon and the
Prussians aided by Russians a
participant in this battle was a
Russian general Petr Bagration
until 1945 city was situated in
East Prussia Germany and was
called Eylau

Baguette (ba gay) ent in diamond
cutting picture J 350

Baguio (ba gay o) formerly summer
capital of Philippine Islands in
mountains in Luzon 130 mi n of
Manila pop 29 262 maps P 195
A 467

Baguio a tropical storm P 194 picture
I 222

Bahai (ba hay) faith a religious
movement growing out of Babiism
founded in Persia 1844 by Mirza
Muhammad who took title of the
Bab (gate or door) the Bab
prepared the way for Mirza Hussein
Ali called Bahaullah (1817-92)
under whom the gospel of the one-
ness of mankind spread in the East
Under Bahaullahs son Abdul
Baha (1844-1921) movement was
carried to Europe United States
and Canada later spread to Central
and South America B 18

Bahai Temple at Wilmette Ill pic
I 248

Bahamas (ba hamz or ba ha ma)
group of islands Brit sh West
Indies 4400 sq mi pop 76 000

B 17 W 93 maps B 17 W 96
I 253 pict re B 17

lumber reaches B 17 C 418b
relationships to continent maps
N 245-6 248 250 I 258

sponges S 354 sponge boats pic
I 253 B 17 W 96

Bahaullah (ba ha la) (1817-92)
Persian religious leader B 18

Bahai Temple at Wilmette Ill pic
I 248

Bahawalpur (ba wal pur) princely
state of w Pakistan administra-
tively associated with Punjab prov-
ince area 17 471 sq mi pop
18 315 cap Bahawalpur before
1947 becoming part of Pakistan in 1947
Lahawalpur was a princely state
affiliated with India map I 68a

Bahia (ba ya) state of Brazil on
central seacoast 204 593 sq mi
pop 4 900 419 cap Salvador

B 291 maps S 252

Bahia city in Brazil See in Index
Salvador

Bala Bianca Argentina seaport and
railroad center pop 112 597 ex-
ports wheat wool government
naval station A 354 maps A 351
C 453

Bahrela (ba ren) Islands British
protected state in Persian Gulf pop
1 9 650 chief island Bahrein
97 mi long and 10 mi wide it-
to n. Manama is cap of state;
A 285 maps A 285 A 408

pearl fisheries A 287
petroleum A 288 P 165

Babit or **bat** the monetary unit of
Thailand (Siam) historical value
44 cents formerly called tical

Batutu short dark people of Belgian
Congo ruled by Batuzi

Baikai (bi kai) lake in s Siberia
B 16 A 413 maps R 259 A 408 411

inhabitants of region M 346
size comparative See in Index

Lakes table

Bull cricket C 511

Bull legal term for the security given
by one person so that another
under arrest may enjoy his free-
dom until the date of his trial

Bulle Atha (Clath) Ireland See in
Index Dublin

Bailey Carolyn Sherwin (Mrs Eben
Clayton H.) (born 1875) writer
born Hockley Falls N Y author
of more than 35 children's books
the first one published 1904 These
include Pioneer Art in America
Tops and Whistles True Stories of
Early American Toys and Chil-
dren Children of the Handicraft

French u German B gem; go thin then d=French hard (Jeant) h=French f (s in assure) K=German guttural ch

- 'Enchanted Village'. Received Newbery medal in 1947 for 'Miss Hickory', illustrated by Ruth Gannett.
- Bailey, Florence Augusta Merriam** (1863-1943), ornithologist, born Locust Grove, N.Y.; sister of Clinton Hart Merriam and wife of Vernon Bailey ('Handbook of Birds of the Western United States').
- Bailey, Hackaliah**, American showman C-311
- Bailey, James Anthony**, real name James Anthony McGinness (1847-1906), circus partner of P. T. Barnum, born Detroit, Mich.: C-311-12
- Bailey, Liberty Hyde** (1858-1954), botanist and horticulturist, born South Haven, Mich.; professor horticulture 1883-1903; dean of College of Agriculture 1903-13, Cornell University; made important investigations in horticulture, rural economics, and education; editor, standard encyclopedias of horticulture and agriculture, poet ('Wind and Weather'); author of many books on gardening ('The Garden of Larkspurs')
- Bailey, Vernon** (1864-1942), biologist, born Manchester, Mich.; chief field naturalist, U.S. Biological Survey 1887-1933 ('Life Zones and Crop Zones of New Mexico'; 'Mammals of Oregon')
- Bailey wall**, of medieval castle C-132, picture C-133
- Bailiff**, an officer of court whose chief duties are generally to preserve order and to take charge of prisoners under arraignment in England the term is applied to a superior servant or agent and also to an officer of the court.
- Baillic, Joanna** (1762-1851), Scottish poet and dramatist ('Plays on the Passions'; 'De Montfort'; many simple songs and poems of much charm).
- Bailly (ba-lyé)**, Jean Sylvain (1736-93), French scholar, born Paris; wrote important treatises on astronomy; executed in Revolution.
- Bailment**, in law. See in *Index* Law, table of legal terms
- Bail out**, in aviation, expression meaning to jump from an aircraft with a parachute.
- "Baily's beads," mountains on moon M-382
- Bain, Alexander** (1818-1903), Scottish philosopher and educator; raised standard of education in Scotland, and greatly influenced teaching of grammar and composition; first British educator to stress necessity of separating psychology from metaphysics; made a study of physical origin of feeling and emotion.
- Bainbridge, William** (1774-1833), U.S. Navy officer, born Princeton, N. J.; in war with Tripoli commanded the *Philadelphia*, captured a Moorish frigate, but was himself taken prisoner with more than 300 men; in War of 1812, in command of the *Constitution*, captured the British *Jawa* off the coast of Brazil in a terrific combat.
- Baird, John Logie** (1858-1946), Scottish inventor of television, first practical television apparatus T-54d
- Baird, Spencer Fullerton** (1823-88), naturalist, born Reading, Pa.; made vast collection of North American vertebrate fauna; secretary of Smithsonian Institution; as head of Commission on Fish and Fisheries, organized science of fish culture; started the marine laboratory at Woods Hole, Mass., deep-sea exploration D-455
- Baireuth**, Germany. See in *Index* Bayreuth
- Bairnsfather, Bruce** (born 1888), English cartoonist, born Murree, India; famous for his World War I cartoons of 'Old Bill', and a play about him, 'The Better 'Ole'; founded *Fragments*, a weekly comic paper.
- Balt**, in fishing artificial lure F-118c, 118f, pictures F-118c-d
- live bait** F-118b, picture F-118b
- Balt casting** F-118b-d, picture F-118c
- lure** F-118c, pictures F-118c
- rod and reel** F-118c, picture F-118a
- Balting**, in falconry F-15
- Batze (báz)**, a loosely woven, napped woolen or cotton fabric, finished to imitate felt; used for table covers, linings for jewelry and instrument cases, etc.
- Baja California**, Mexico. See in *Index* California, Lower
- Bajaus (ba-gons')**, a native tribe of British North Borneo; principal settlements along Tampasuk River; Bajau a synonym for "pirate."
- Bajazet (ba-gú-zét')**, or Bayazid (bá-yú-zéd') I (1347-1403), first Ottoman sultan, victor over allied Christian armies at Nicopolis (1396) defeated by Mongols M-346
- Bakan**, Japan. See in *Index* Shimonoseki
- Bakelite**, the phenol formaldehyde plastic invented by Leo H. Baekeland I-201-2, P-314, C-371, table I-199
- electric insulating properties** E-297, 298
- Baker, Bryant (Percy)** (born 1881), American sculptor, born London, England; works include 'The Pioneer Woman', at Ponca City, Okla.; 'Pioneer Mother', Topeka, Kan.; statues of Woodrow Wilson and King Edward VII of England; many portrait busts.
- Baker, George Fisher** (1840-1931), banker and philanthropist, born Troy, N. Y.; many years president First National Bank, New York City; director U. S. Steel Corporation and many other companies; from small clerkship in state banking department rose to dominant position in American finance; gave millions for educational and benevolent purposes.
- Baker, George Pierce** (1866-1935), educator, born Providence, R. I.; professor of English and director of 'The 47 Workshop' at Harvard University 1905-24; professor of drama and director of University Theater at Yale, 1923-33; leader in revival of American drama.
- Baker, Newton Diehl** (1871-1937), lawyer and political leader, born Martinsburg, W. Va.; city solicitor of Cleveland 1902-12; mayor of Cleveland 1912-16; U. S. secretary of war under President Wilson 1916-21; member Court of International Justice 1928; member Law Enforcement (Wickersham) Commission; picture W-236
- Baker, Nina Brown** (born 1888), author, born Galena, Kan.; books for teen-age boys and girls, chiefly biographies of great people of other lands and other times ('He Wouldn't Be King; the Story of Simón Bolívar', 'Juarez, Hero of Mexico', 'Sir Walter Raleigh', 'Sun Yat-sen').
- Baker, Ray Stannard** (1870-1946), writer, born Lansing, Mich.; director American Press Bureau at Paris Peace Conference; author of articles on industrial and political problems; wrote 'Adventures in Contentment' and other idyllic rural studies under pseudonym "David Grayson"; 'Woodrow Wilson—Life and Letters', monumental biography; 'American Chronicle', autobiography.
- Baker, Remember** (1737-75), leader of Green Mountain Boys.
- Baker, Sir Samuel White** (1821-93), English explorer, born London; discovered Lake Albert 1864.
- Baker, Mount**, volcanic peak of Cascade Range in n. w. Washington; 10,750 ft.; maps W-37, 44
- Bakeries** B-295-8
- air conditioning** A-77
- 200 Z-357**
- Baker Island**, a tiny sand and coral island in mid-Pacific, colonized by the United States in 1935 for use as a way station for planes flying from the Hawaiian Islands to Australia; pop. 3; map P-17
- Bakersfield, Calif.**, trading and manufacturing city 100 mi. n. of Los Angeles in oil and farming region; pop. 34,764; oil refineries; packed fruits, agriculture and oil tools; Bakersfield College; maps C-35, U-252
- climate** C-38
- Baker University**, at Baldwin, Kan.; Methodist; founded 1858; liberal arts, fine arts.
- Bakewell, Robert** (1725-95), English farmer, established scientific stock breeding C-141a
- Bakin (bá-kén)** also called Takizawa
- Baljin and Kyokutei Bakin** (1767-1846), Japanese romantic novelist, born Tokyo, Japan.
- Baking** C-463
- bread** B-295-7
- cakes and crackers** B-298
- prepared mixes** B-295
- silicone glaze for baking pans** S-150
- Baking powder** B-18-19
- alum** in B-18
- ammonium bicarbonate** A-236
- gluten holds** G-166
- in self-rising flour** B-295
- Baking soda**, sodium bicarbonate S-225
- in baking powder** B-18
- Solvay process produces** S-226
- Bakst (bákst)**, Leon Nikolajewitch (1868-1924), Russian genre and portrait painter and decorative designer; noted for stage settings and costumes, especially for Diaghilev's Russian Ballet; T-115
- costume**, picture A-4001
- Baku (bá-ko')**, Russia, oil center and seaport, capital of Azerbaijan Soviet Socialist Republic, on w. coast of Caspian Sea; pop. 500,000; C-152, maps R-267, E-417
- sacred fire** from natural gas G-51
- Bakunin (bá-kon'yín)**, Michael (1814-76), Russian anarchist and a founder of Nihilism; exiled to Siberia for life; escaped to Europe; founded Social Democratic Alliance which soon merged with the International; his views were so anarchistic he was expelled from International and went to Switzerland, where he died.
- BAL**, antidote for lewisite C-205
- Balaam (bá-lám)**, prophet disobedient to divine command until miraculously rebuked by his ass; compelled against his will (Num. xx-xxiv) to bless Israel.
- Balakirev (bá-lá-ké-ré')**, Mili Alexeyevitch (1837-1910), Russian composer; a follower of Glinka, he became leader of Young Russian School of music with "truth and nationalism" as battlecry; overtures, incidental music to 'King Lear', a piano fantasy 'Islamey', songs.

Bal klava (bā klā vā) port of the Crimea 6 mi from So atopol scene of battle of Oct 25 1854 during Crimean War which was immortalized in Tennyson's poem *The Charge of the Light Brigade* map R 267

Balalaika (bā lā dī kā) Russian stringed musical instrument similar to a guitar usually consists of triangular body with long neck

Balance See *Index Libria*

Balance for weighing W 85

Balance in accounting B 229 230

Balance in arts A 400h 4

Balance in interior decoration I 183-4

Balance of the body See in *Index Equilibrium*

Balance of nature N 63 B 190-1 I 153 G 169 diagram N 63 *Refer* *ence Outline* N 68b See also in *Index Ecology* Struggle for existence

Balance of payments I 194 table I 193

Balance of power cond u among nations in which none has sufficient power to endanger the independence of the others

Europe E-433

Balance of trade I 194

favorable balance meaning I 194

foreign exchange F 233

imports and exports of U S com pared I 193

mercantile theory T 165-6 I 194

Balance sheet in accounting A 7 B 230

Balance wheel of watch W 56 57

resembles torsion pendulum P 118

Balanchine (bald ā shān) George (born 1904) American ballet dancer and choreographer born St Petersburg (Leninград) Russia ballet master of Diaghilev's Russian Ballet 1924-28 for which he composed *The Nightingale* *Prodigal Son* *Gods Go a Begging* came to U S 1933 became citizen 1940 produced ballets for Metropolitan Opera and for ballet companies musical comedies and motion pictures author of *Complete Stories of the Great Ballets* B 285 D 14m

Symphonic Concertante picture B 28a

Balard (bā lār) Antoine Jerome (1802-70) French chemist discover of bromine

Balau ruby a rose red to pink spinel used as a gem

Balata (bā lā tā or bā lā tā) a rubber gum obtained from the bark of the evergreen bullet tree (*Mimosa* sp.) native to West Indies and South America used as substitute for gutta percha and in cables golf balls moccasins beltline

Balaton (bā lō tōn) Lake or German *Platten see* (plātēn) largest lake in Hungary 60 mi s w of Budapest 50 mi long 6-10 mi wide rich with fish popular resort H 445 maps B 23 D 16 E 416

Balbo Italo (1892-1940) Italian air marshal governor of Libya made head of Italian armed forces in North Africa 1937 killed in air plane crash in Libya picture I 273 transatlantic flight table A 104

Balboa (bal-bō ā) Vasco Núñez de (1475-1511) Spanish explorer discovered Pacific B 19-20 picture P 11 color picture B 19

route map A 189

Balboa Pacific port of Panama Canal Zone 3 mi e of city of Panama pop 4162 P 63 map P 62

Balboa monetary unit of Panama historical value \$1.00

Balbriggan seaport in Ireland about 20 mi n e of Dublin pop 2900 balbriggan hosiery and underwear made of fine unbleached cotton

originated here England and America now the chief producers name balbriggan also known as jersey cloth with mixed colors map B 325

Balbriggan cloth I 8

Balch (bōlch) Emily Greene (born 1867) economist and sociologist born Jamaica Plain Mass teacher Wellesley College 1896 1913 in international secretary Women's International League for Peace and Freedom 1919 '24 (honorary president 1938) shared 1946 Nobel peace prize with John R Mott

Balden Bernt (born 1889) aviator born Norway joined Norwegian Air serv a 1918 pilot for North and South Polar expeditions with Amundsen Byrd Elsworth and Wilkins made commander U S Air base in Greenland 1941 with U S Army Air Corps during World War II director Royal Norwegian Air Lines 1946 48 with U S Air Force since 1948

flies Byrd to South Pole (1929) B 373 table A 104

Balden C 472

Bald cypress or southern cypress C 534 color picture P 291 table W 185b

Bald eagle E 187 pictures I 187 169 color picture B 181

Balder (baldēr) Norse god B 20

Balder a brow flower B 20

Baldness or alopecia H 243

Baldovineti Alexee (1425-99) Florentine painter and decorative artist noted for Biblical paintings and portraits famous mosaic decorated altars banners chests expimented with oil paints and methods of mixing colors also with science of perspective

Baldpate duck (Mare americana) D 159

Baldwin I (1058-1118) adventurer prince of First Crusade youngest brother of Godfrey of Bouillon first king of Jerusalem crowned 1100

Baldwin Abraham (1754-1807) statesman born North Guilford Conn chaplain in Revolutionary War moved to Georgia 1784 signed United States Constitution first president of Frank's College member of Georgia's first House of Representatives U S senator 1799 1807

Baldwin Elias J (Lucky) (1828-1905) discovered famous Ophir gold mine Nevada lost his fortune and tried again unsuccessfully in Africa

Baldwin Frank Dwight (1840-1903) U S Army officer born Manchester Mich fought in Civil War and in Philippines but best known for his work against the Indians picture S 305

Baldwin James (1841-19) author and compiler born Hamilton County Ind edited schoolbooks and mythological and other classical stories for children (*Old Greek Stories* *Four Great Americans* *The Golden Fleece*)

Baldwin James Mark (1861-1934) psychologist born Columbia S C professor of philosophy and psychology University of Toronto Canada Princeton and National Universities of Mexico well known in verity of Mexico social and experimental fields of psychology (*Story of the Mind* *Mental Development in the Child and the Race* *History of Psychology*)

Baldwin Matthias W (1779-1866) inventor born Elizabethtown NJ

built first locomotive to draw a train in Pennsylvania laid foundation for Baldwin Locomotive Works Philadelphia Pa

Baldwin Robert (1840-89) Canadian statesman B 20 C 99

Baldwin Simcoe Eben (1810-1927) jurist born New Haven Conn chief justice Connecticut Supreme Court 1907 10 governor of Connecticut 1911 15 member of faculty Yale Law School 1889-1919 one of founders of American Bar Assoc at on

Baldwin Stanley first Earl Baldwin of Bewdley (1867-1947) British statesman active head of family's iron and steel works 1902-1916 elected to Parliament 1908 as chancellor of exchequer 1920 '23 headed mission to that arranged funding of British war debt to U S (1922) Conservative prime minister and first lord of treasury 1923-24 1924 29 1935 37 made earl in 1937 by George VI (Classics and the Pantheon *This Torch of Freedom* *Service of Our Lives*) B 270

Baldwin William Warren (1775-1844) Canadian political leader lawyer and physician born Erie and member of Legislative Assembly of Upper Canada 1824 30 leader of the Reform party father of Robert Baldwin

Baldwin Locomotive Works Philadelphia Pa P 190

Baldwin Wallace College at Berea Ohio Methodists founded 1845 arts and sciences education business administration home economics music religion

Baldy Peak in New Mexico, in Sangre de Cristo Range (11,623 ft.) map N 279

Bale John (1495-1563) British author bishop of Ossory Ireland champion of Reformation wrote mystery and miracle plays King John forerunner of English historical drama and a bibliography of English literature (*Index Britanniae scriptorum*)

Bale Switzerland See in *Index Basel*

Bale cotton C 495 pictures C 498 N 169 rubber P 238 pictures R 240 wool pictures W 192 193

Baleares (bā lā ē or skā) Islands Spanish *Baleares* (ba lā ē rā) province off e coast of Spain 1935 40 mi pop 420 127 B 20 maps S 312 E 425

Baleen or whalebone W 114 pictures W 114 A 250a

Baleen whale W 114 pictures W 114 A 250a

Balentine (bā lē tē n) Charles Wolcott (1861-91) author and publisher born Rochester N Y (*Life of John G Blaine* *A Victim of Defeat*)

collaborates with Kipling K 49 Kipling's elegy quoted K 49 51

Baile (bā lē) Michael William (1803-70) Irish composer born Dublin studied on the continent prolific composer best known work is light opera *The Bohemian Girl*

Balfour Arthur James Balfour first Earl (1848-1930) British statesman born Scotland chief secretary for Ireland 1887 91 became Conservative leader of House of Commons 1891 prime minister 1902-5 retired in 1911 returned to politics at outbreak of World War I and served as first lord of the Admiralty 1915 16 foreign secretary 1916-19 author of Balfour Declaration on Palestine leading British delegate to the Washington Conference 1911-22 raised to peerage

1922; author of 'Foundations of Belief', 'Theism and Humanism'.

Balfour Declaration, statement on Palestine mandate P-46

Ball (*bāl'le*), mountainous island of Indonesia, situated just east of Java; about 2160 sq. mi.; pop. 1,101,393; people resemble Javanese, but with Hindu strain; skillful craftsmen; traces of ancient Hindu culture; old form of Brahmanism chief religion; exports rice, cocoa, coffee: maps E-202, A-407

animals and Wallace's line E-204, B-160

clothing, pictures E-208

doll, color picture D-122c

people, pictures E-208

temple god, picture E-208

Ballila (*ba-lē'la*), Italian Fascist military organization of boys under 14; similar to Boy Scouts; named in honor of Italian youth who in 1746 hurled a rock at Austrians who were besieging Genoa: I-275

Ballne, Israel. See in *Index* Berlin, Irving

Balliol, or **Balliol** (*bāl'yūil*), name of a royal English family which emigrated to England with William the Conqueror. Sir John de Balliol (died 1269) married Scottish princess descended from King David I of Scotland and founded Balliol College; his son John (1249-1315) claimed Scottish throne and as vassal to Edward I of England, ruled 1292-96; his grandson, Edward, ruled in 1332: S-64

Balkan Entente (*ai-tant'*), formed by Yugoslavia, Rumania, Greece, and Turkey in 1934; collaborated in economic matters and communications, wrecked by Axis penetration in World War II: Y-347

Balkan League B-26

Balkan Mountains, in the Balkan Peninsula, an extension of the Carpathians, from Iron Gate of Danube, extend s through Serbia, then turn e to Black Sea; divide Danube and Maritsa watersheds: B-21, maps D-16, B-23, E-419

Balkan Peninsula, s e peninsula of Europe B-21-7, maps B-23, E-416-17, 419, pictures B-21-2, 24-7. See also in *Index* Balkan States

bibliography B-27

Christmas customs C-294b-5

history B-21-7, charts H-366, 367

natural features B-21

people B-21, 23-4; Slavs S-198

Balkan States, the countries of the Balkan Peninsula, at present Albania, Bulgaria, Greece, Yugoslavia, Rumania, and European Turkey. See also in *Index* Balkan Peninsula; Balkan wars; Crimean War; Russo-Turkish wars; and individual states by name

Balkan wars

(1828-29) G-191

(1877-78) B-26; Bosnia and Herzegovina B-256; Disraeli's diplomacy D-105

(1912-13) B-26

Bulgaria B-349-50

Greece, territorial gains G-193

Macedonia M-7

Rumania R-254

Serbia S-102

treaty signed at Bucharest B-26

Balkh (*bāik*) (Turkish 'high town'),

Afghanistan, chief city of district of Balkh; ancient city (Bactra)

early rival of Babylon and Nineveh; center of Zoroastrian religion; pop. 12,488: maps A-406, P-156

Balkh, district of Afghanistan. See in *Index* Bactria

Balkhash (*bāl-kāsh'*), lake in the

Kazak Soviet Socialist Republic,

near Chinese border; w. section

contains fresh water from Ili River, e. section is salt; about 6370 sq. mi.; 4th largest lake in Eurasia: R-257, maps R-259, A-406, 411

Balk line, in billiards B-144

Ball, John (died 1381), a leader in

Wat Tyler's Rebellion T-227

Ball, Lucille (Mrs. Desi Arnaz, *dē'-zi ar'nāz*) (born 1911), actress, born Jamestown, N.Y.; motion pictures include 'The Big Street', 'DuBarry Was a Lady', and 'Sorrowful Jones'; won television Academy award for best comedienne of 1952; stars in and produces 'I Love Lucy', television program, with husband, Desi Arnaz (born 1917), band leader and actor, born Cuba, citizen of U.S. after 1942.

Ball, Mary, maiden name of George Washington's mother W-17-18

Ball, Thomas (1819-1911), sculptor, born Charlestown, Mass.; work shows dignity, sincerity, and accuracy of subject ('Emancipation Group'); equestrian statue of Washington in Boston.

Ball, William, great-grandfather of George Washington W-17

Ball. See in *Index* Baseball; Basketball; Billiards; Bowling; Cricket; Field hockey; Football; Golf; Jai-alai; Lacrosse; Ping Pong; Polo; Tennis

Ballad P-333, 337, E-376a, 379, L-98b folk songs F-193-4, 195, 204

Robin Hood R-164, 165

Scott's interest in S-67

survival in Great Smoky Mountains

G-187

Ballade (*bq-lād'*), verse form derived from the French, having two variations, the shorter being the more common; consists of three stanzas of 8 or 10 lines each, followed by an envoy of 4 or 5 lines, the last line of each stanza and of the envoy being the same and the rhyme sounds being limited to three or four (*ababbcb* or *ababbccdd*, in envoy *bcb* or *ccdd*): example: W. E. Henley's 'Ballade of Dead Actors'.

Ballad opera, an English form of light opera O-397-8

'Beggars' Opera' O-398, picture O-395

Ball-and-claw-foot, in furniture I-178

Ballarat (*bāl-a-rāt'*), Australia, city of Victoria, 65 mi. n.w. of Melbourne; pop. 40,214, including suburban area; woolen mills; formerly gold-mining center: map A-489

Ballast. See also in *Index* Nautical terms, table

balloons B-30, 32-3

submarines S-435

Ball bearing

X-ray test, picture X-331

Ball bullet, military bullet A-236a

Ball clay C-341

Ballen Islands, group of five, in Antarctic Ocean, about 300 miles s.w. of Victoria Land; volcanic origin; discovered 1839 by John Balleny, English shipmaster: maps A-259, W-205

Ballet (*bāl'a* or *bā-lā'*), a theatrical dance B-28-28d, D-14, 14g-j, 1, pictures B-28-28d, D-14, 14i, A-400i

Degas's art

'Ballet Class' P-31d, color picture P-31c

'Dancer Bending Forward' D-137-8, picture D-137

history D-14g-j, 1

musical shows D-14m, pictures D-14i, O-397

opera O-388

Pavlova P-100, picture P-100

Russia R-275, picture R-273

toe dancing D-14h

training for D-14a

Ballet, in music. See in *Index* Music, table of musical terms and forms

Ball'in, Albert (1857-1918), German shipowner; director-general Hamburg-American Steamship Line, which he developed from insignificance to predominance; practically reorganized German shipping trade.

Ballinger, Richard Achilles (1858-1922), lawyer, born Boonesboro, Iowa; secretary of the interior under Taft: T-3-4

Balliol. See in *Index* Balliol

Balliol College, Oxford University, England O-434

Ballista, war machine used in ancient times for hurling stones M-14, W-9

Ballistics (from *ballista*, ancient machine for hurling stones), science treating of impact, path, and velocity of projectiles; interior ballistics treats of motion of projectile in gun; exterior ballistics, of motion after leaving gun.

Ballistite, an explosive E-458

Ball lightning L-241

Ball mill

cementmaking type C-166, pictures C-164

Balloon B-28d-36, pictures B-28d-33, 35-6. See also in Index Airship

Andrée's wrecked balloon found, picture P-351

barrage against air attack B-30, 36, picture B-31

blimp B-30-1, 32-3

captive B-29, 30, 33, 34, picture B-31

dirigible. See in *Index* Airship

early types B-33-4, picture B-28d

first ascent by man B-33

free B-29, 30, 33, picture B-31:

blimp used as B-32

gas B-28d-9, 30: coal gas B-28d-9;

helium H-331, B-28d-9, 32-3; hydrogen H-459, B-28d-9, 32, 33-4

highest ascents B-36, diagram A-455, picture B-35

kite type B-30, picture B-31

military and naval use B-30-1, 32-3, 34, 36

observation B-30-1, 32, 34, pictures B-31, 35

parachute P-72, pictures P-73

round B-29, 30, picture B-31: blimp

pilots trained in B-32

scientific use B-33, 34-6, diagram

A-455, pictures B-35: meteorology

B-33, diagram A-455, picture

B-33, P-350b: cosmic ray research

R-32

sounding balloon B-33, diagram

A-455, picture B-33

stratosphere B-30, 34-6, diagram

A-455, pictures B-35

Balloonet, small inflated bag kept

within a spherical or dirigible bal-

loon for purpose of retaining shape

after loss of gas.

Balloonflower (*Platycodon grandiflorum*), an herbaceous garden

perennial of the bluebell family, with

large terminal bell-shaped white,

blue, or purple flowers, which in the

bud resemble balloons

how to plant, table G-17

Balloon vine, an annual herbaceous

garden climber (*Cardiospermum*

halicacabum) of the soapberry

family, with small white flowers,

deeply toothed leaves, and balloon-

like seed pods.

Ballot B-36-7

ancient Athens B-36, A-338-9

secret: in England G-118, picture

C-318

short ballot B-37, C-498

Ball point pen, fountain pen with a

tiny ball for a point P-116

Ballroom dancing, or social dancing

D-14m

Ball's Bluff, Va., a bluff on Potomac

River about 33 mi. above Washing-

Key: cāpe, āt, fār, fāst, whqt, fql; mē, yēt, fērn, thēre; ice, bīt; rōw, wōn, fōr, nōt, dō; cōre, būt, rjde, fūll, būrn; out;

ton Confederate force under General Evans defeated Union force and killed its commander Col Edward D Baker Oct 21 1861 map C 335

Balm of Meilasa a perennial garden herb or shrubby plant (*Melissa officinalis*) of the mint family rather hairy and loosely branched with lemon scented leaves and clusters of yellowish white flowers used for culinary flavoring in perfume and in medicine

Balmaceda (*Bal ma sa*) José Manuel (1840-91) elected president of Chile 1886 instituted reforms and extensive public works made himself virtual dictator C 256

Balmer Johann Jakob (1825-98) Swiss physicist S 333

Balm of Gilead an aromatic resin obtained from a small oriental evergreen tree of myrrh family alluded to by ancient writers as a precious and curative ointment

Balm of Gilead poplar a balsam poplar P 373

Balmoral Castle in Aberdeenshire Scotland has been a British royal residence from the time Queen Victoria lived there

Balmung in Teutonic mythology the powerful magic sword of Siegfried called *Gram* in Norse mythology and *Nothing* in Wagner's opera Siegfried

Siegfried legend S 177, N 232

Balopetion S 392

Balor of the Evil Eye god in Irish legend B 231

Balsa a boat, picture B 222b

Balsa a raft of light wood or hides picture B 218

Balsa a tropical tree found chiefly in Ecuador wood is the lightest known about half as heavy as cork but strong and elastic composed of minute cells in which air is confined first used extensively in World War I now employed in life rafts and life preservers air planes, submarines and dirigibles and as soundproof and insulating material

used for model airplanes A 107

Balsam mixture of volatile oils and resins exuded by trees C 232

Canada balsam C 232 F 72

Balsam garden a succulent garden annual (*Impatiens balsamifera*) of the touch me not family with low leafy stem and showy single or double irregular white rose red or yellow flowers clustered in the axils of the leaves on short stalks

Balsam apple a tendrill climbing plant of the genus *Momordica* of gourd family leaves heart shaped lobed flower solitary small yellow or white fruits sometimes sulfur yellow oval sometimes rough native to Africa and Asia

Balsam pear in same genus is similar has coarser foliage fruit used as food and used in medicine

Balsam Coast El Salvador S 32

Balsam family or *Balsaminaceae* (*bol sa-mi-na-se*) a family of plants including the jewelweeds or touch me nots and garden balsam **Balsam fr P 72 picture F 72**

Balsamo Joseph See in *Index* Cagliostro Alessandro

Balsam of Peru or *Peruvian balsam* a product of the tree *Myroxylon peruvianum* of the bean family used in medicine (in perfume) and as substitute for vanilla obtained from El Salvador S 32

Balsam of Tolu a balsam obtained from a tree of the genus *Myroxylon* found in Colombia particularly near Tolu and in Venezuela and Peru

similar to balsam of Peru used in medicine and perfumery

Balsam poplar P 370

Baltic River in a Mexico flows 500 mi w to Pacific M 191 maps M 189 194-5

Baltazar (*bal ta zar*) one of the Wise Men of the East See also in *Index* Magi

Baltic battle of the or battle of Copenhagen B 37 N 109

Baltic provinces in czarist Russia the provinces of Courland Livonia and Estonia on the Baltic Sea later the soviet republics of Latvia and Estonia See also in *Index* Baltic States

Baltic Sea B 37 maps N 301 E 416

See 419 424 See also in *Index* 1) can table

canals C 108 L 281 V 523

chief source of amber A 186

Puss a gets foothold P 167

Sweden a pop saw nns 9 466

Baltic States a collective name of Estonia Latvia and Lithuania during 1918-40 their period of independence from Russian rule See also in *Index* Est nia Latvia Lithuania a also Baltic Provinces

Baltic White Sea Canal R 281 C 198

See 419 424 *Index* Canals table

Baltimore *teclius* or Cecil Calvert "d Baron (1605-74) founded Maryland B 38 M 110 picture R 38 grants religious freedom C 303 M 110

Baltimore Charles Calvert 3d Baron (1637 1715) proprietor of Maryland B 38

Baltimore George Calvert first Baron (1540?-1632) founder of Avalon colony in Newfoundland (1621) applied for charter for Maryland which was granted after his death to his son Cecilus B 38 picture B 38

Baltimore MD chief city of state pop 947,708 B 39 41 C 225b maps M 117 U 253 picture B 39-41 M 108 119

Enoch Pratt Library picture L 189

fire (1904) B 41

first system of gas street lighting G 30

first telegraph line T 38

museum E 41 See in *Index* Mus eums table

Penbody Institute P 101

presidential convention See in *Index* 4th Convention table

War of 1812 B 41 W 14

Baltimore & Ohio Railroad M 109

R 59 T 172

Atlantic locomotive picture R 60

Baltimore butterfly R 387c

Baltimore clippers S 159 M 109

Baltimore colts O 425 picture O 424d

color picture B 163

new picture B 173 O 424d color picture B 163

state bird table B 158

Baluchis (*ba la chis*) members of the dominant race of TurkoIranians of Baluchistan from whom that country took its name

Baluchistan (*ba la chis ta*) region of a Pakistan bordered by India and Punjab (Pakistan) includes the province Baluchistan (area 54,456 sq mi) and Baluchistan States Union (area 19,548 sq mi) pop 5,019,785 The region is mountainous, largely dry and barren It is rich in minerals including coal gypsum chromite sulfur lead gemstone and brine salt Before joining the Dominion of Pakistan in 1947-48 Baluchistan had been administered by princely families and British India a maps I 68a

Bala chitram prehistoric monster E 454

Balsac (*bal a*) French *bal a*) Honoré de (1798-1860) French novelist B 42 F 238 picture B 42

Bamako (*ba ma ko*) capital of French Sudan in W Africa on navigable Niger River connected by rail with Dakar pop 29,000 maps A 46

Bambala a Bantu speaking people of dark brown color in the Congo region central Africa

Bamberg (*bam ber*) Germany Bavarian city 33 mi n of Nuremberg pop 76,180 11th century cathedral has large breweries and cotton and woolen mills maps G 88 E 425

Bambusa a tree-like grass B 42-3 G 168 picture B 42

ident had with several plant groups P 230

producing regions B 42 China C 271

uses B 43 filaments in electric light bulb C 310 houses P 190 7 pic 1 res P 190 C 389

Bambusa (*bam ba ko*) a dance L 118

Bamla (*ba la*) valley and pass in Afghanistan 60 mi n.w. of Kabul colossal Buddist idol carved in rock other historic remains city destroyed (122?) by Genghis Khan

Ban (*ba*) plural *bani* (*ba ni*) 1) man an coin 100 equal one leu (historical val e of leu 1 cent)

Ban ak or *Bannock* *Shoshonean* Indian tribe of n.w. plateau region of U.S. formerly moved through S Idaho

Banana B 43-6 pictures B 43-5 color picture F 312

fruit B 46

food value B 45-6

growing and shipping B 44-5

picked when green B 45

plant u s F 46

plantation B 44-5 Guatemala picture B 44 Honduras picture M 417

produce n regions B 44 Central America C 170 G 222b picture C 170

B 417 Jamaica B 45 picture R 292 Panama P 51 picture P 52

varieties B 46

Banana oil popular name for amygdalate a colorless liquid of fruity odor very useful as an organic solvent used in lacquers and artificial fruit essences

Bannas Ind a See in *Index* Benares

Banat of Temesvar (*ba na to ven sh tar*) fertile district lying between Danube and Theiss rivers and Transylvanian Alps 11,020 sq mi formerly part of Hungary later divided between Rumania and Yugoslavia Banat means province or district Temesvar Rumanian Timisoara (a prince pal city)

Banbury England market town in Oxfordshire 6.5 mi n.w. London center of zeolite deposits in 17th century celebrated in rhyme "Ride a cock horse to Banbury Cross" pop 19,917 map B 325

Banico del Gopo Venice Italy B 51

Banico di Rialto Venice Italy B 51

Bancroft George (1800 1891) historian and statesman born Worcester Mass as secretary of navy to President F K planned Naval Academy at Annapolis (History of the United States) A 227

Hall of Fame table B 248

Bancroft Hubert Howe (1832-1918) historian born Granville Ohio important histories of Western states ("West American Historical Series")

Bancroft Richard (1544-1610) archbishop of Canterbury zealous and bitter foe of Puritans became bishop of London 1597 archbishop

ba=French u German & gem so thin then n=French nasal (Jean) ch=French j (je in azure) k=German guttural ch

- of Canterbury 1604; "chief overseer" of translations for authorized version of Bible.
- Bancroft, Sir Squire** (1841-1926), English actor and manager; married actress-manager, Effie Wilton, with whom he produced many plays; published his reminiscences 'Empty Chairs' (1925).
- Band** (music) B-46-46d, *pictures* B-46-46c
books about B-46d
derivation of word B-46c
distinguished from orchestra O-402
harmonica bands H-269
history B-46c-d
military band B-46c, d, O-402, *pictures* B-46a-c, O-404
school B-46-46d, *picture* B-46b
- Band'a**, group of tribes in French Equatorial Africa n of Ubangi River; use lip disks.
- Banda Islands**, Indonesia, part of Molucca Archipelago, in Banda Sea, 60 mi. s. of Ceram; 20 sq mi.; pop. 13,036
nutmegs and mace N-316
- Bandar**, India *See in Index* Masulipatnam
- Bandar** (*bân'dâr*), or Rhesus monkey M-352, 353, *picture* M-348
- Bandar Ab'bas**, Iran, seaport on Strait of Ormuz Persian Gulf, pop. 15,233; exports fruit, tobacco, wool, carpets, opium; *maps* 1-224, A-406-7
- Bandar Shah**, Iran, strategic port on Caspian Sea, northern terminus of Trans-Iranian Railroad 1-223, *maps* 1-224, A-285
- Bandar Shahrinur**, Iran, strategic port on Persian Gulf; southern terminus of Trans-Iranian Railroad 1-223, *map* 1-224
- Banda Sea**, part of Pacific Ocean, in East Indies, s. of Moluccas; greatest depth about 24,000 ft.; *maps* E-203, F-216
- Banded anteater**, an Australian marsupial K-2
- Banded rattlesnake** R-78
- Banêra**, Pico da, highest mountain of Brazil (9462 ft.) B-288
- Bandelier** (*bân-dê-îer'*), Adolph Francis Alphonse (1840-1914), American archaeologist and historian, born Switzerland; leading authority on archaeology of s.w. United States Mexico, Peru, and Bolivia ('Final Report of Investigations among the Indians of the Southwestern United States').
- Bandeller National Monument**, in New Mexico N-30, *map* N-18
- Ban'dicot**, any of several small, burrowing animals of the marsupial family *Peramelidae*; found in Australasia; feeds on worms, insects, vegetables, and grain: K-2, A-480
- Bandjermasin** (*bân-jêr-mâ'sin*), seaport, chief town in Indonesian Borneo, built mainly on piles; pop. 65,698; exports spices, gold: B-255, *maps* E-202, A-407, *picture* B-256
- Bandoeng**, or **Bandung** (*bân'dong*), city in Java; pop. 750,000: J-327, *maps* E-202, A-407
conference 1955, *picture* H-379
- Bandurria** (*bân-dû-ri-û*), a Spanish wire-stringed musical instrument of lute family.
- Bandy**, Welsh name for hockey.
- Banff** (*bâm'f*), Alberta, Canada, health and pleasure resort in Bow River valley in Canadian Rockies; altitude 4500 ft.; pop. 2357; annual winter sports carnival: N-38f, *maps* C-68, 80, *picture* A-141, *color picture* N-29
- Banff National Scenic and Recreational Park**, in Alberta, Canada N-38f, A-141, *maps* N-38f, C-68, 80, *picture* A-141, *color picture* N-29
- Bangalore** (*bâng-gâ-lôr'*), India administrative capital of Mysore state, in s. part of India; pop. 778,977; textiles, metal, tobacco; *maps* 1-54, A-407
- Bang'kok**, Siamese Krung Thep (*krung t'hâp*), capital of Siam (Thailand); pop. 827,290: B-46d, *maps* 1-123, A-407, *pictures* B-46d, S-171
- Vat Arun**, or **Vat Chang**, *picture* S-170
- Bangor** (*bâng'gôr*), Me., on Penobscot River 60 mi from sea, pop. 31,554; paper, leather, shoes; Bangor Theological Seminary M-46, *maps* M-53, U-253
- Bangor**, old cathedral city on coast of Wales; pop. 12,822, seat of bishopric since 6th century. University College of North Wales; slate quarries: *map* B-325
- Bangs**, John Kendrick (1862-1922), humorist born Yonkers, N.Y. ('A Houseboat on the Styx'; 'Mr Bonaparte of Corsica'; 'The Foothills of Parnassus'; 'The Idiot'; 'Coffee and Repartee').
- Bang's disease**, of cattle C-147
vaccine V-433b
- Bangui** (*bân-gê'*), capital of Oubangui Chari in French Equatorial Africa, on Ubangi River at n.w. border of Belgian Congo, pop. 38,400. *map* A-46
- Bangweulu** (*bâng-wê-û-lô*), Lake, or Bangweolo, Lake, in Northern Rhodesia, 150 mi long, formed by Congo headstreams *maps* A-47, B-109, E-199
discovered by Livingstone L-281
- Bania** (*bân-yâ'*), Indian moneylender I-59
- Banjan tree**, or **banyan tree** B-53-4, *picture* B-54
- Banim**, John (1798-1842), Irish poet, playwright, novelist, called "Scott of Ireland." With brother Michael (1796-1874) wrote famous 'Tales of the O'Hara family'.
- Ban'jo**, a stringed instrument B-46d, *picture* M-471
- Bank**, financial institution. *See in Index* Banks and banking
- Bank acceptance** C-509
- Bank for International Settlements**, set up in 1929 as part of the Young Plan for handling German reparation payments; duties taken over by International Bank for Reconstruction and Development in 1946.
- Bankhead**, Tallulah Brockman (born 1903), actress, born Huntsville, Ala.; daughter of W. B. Bankhead, who was speaker of House of Representatives (plays: 'The Little Foxes', 'Skin of Our Teeth', and 'Private Lives'; motion pictures: 'A Royal Scandal' and 'Lifeboat'; star of radio and television programs); wrote 'Tallulah', autobiography.
- Bank holidays**, England F-59, E-351
- Banking**, of airplane A-92, *diagrams* A-89. *See also in Index* Aviation, table of terms
indicator, *picture* A-93
- Banking acts**. *See in Index* Banks and banking, *subhead* laws
- Bank note**, a form of paper money B-51, M-337. *See also in Index* Paper money
- Bank of Amsterdam** B-51
- Bank of England** B-51, L-301, *map* L-301
- Bank of France** B-51
- Bank of North America** M-395, B-51
- Bank of Sweden** B-51
- Bank of the United States**
first, second banks chartered B-52
Jackson vetoes charter J-286-7
Tyler opposes re-establishment T-227
- Bankruptcy**, legal admission by a debtor that he is unable to pay his debts in full B-46d-7
- Bank's, Sir Joseph** (1743-1820), English naturalist; accompanied Captain Cook 1768-71; first man to study marsupials of Australia; discovered geysers in Iceland.
- Banks, Nathaniel Prentiss** (1816-94), U. S. Army officer and political leader, born Waltham, Mass.; speaker U. S. House of Representatives 1856; governor of Massachusetts 1858-61; Federal general in Civil War; in House of Representatives 1864-77.
- Banks and banking** B-47-53, *pictures* B-47, 49-51. *See also in Index* Money
acceptance C-509
bank notes M-337; origin B-51
branches B-52
building and loan associations B-342
capital, surplus, and undivided profits B-47, 48-9
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Federal Reserve System F-49-50
foreign exchange F-235
frozen assets B-51
insurance of deposits B-51, F-49
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International I-195; International Bank for Reconstruction and Development I-197, W-297
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letter of credit C-509-10
liabilities: to depositors B-47-8; to stockholders B-48-9
liquid assets B-47
loans B-47, 49, F-20
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national B-50, 52
Federal Reserve membership F-49
first in U. S. H-253, B-52
supervision U-360
negotiable instruments C-509
New York financial center N-225
open-market operations F-50
origin of term B-51
overdrafts B-48
postal savings bank B-48
private banks B-50
Renaissance period R-107-8
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Rothschild family R-235
"run" on B-47

Key: câpe, ât, fâr, fâst, whqt, fâll; mâ, yêt, fêrn, thêre; ice, bît; rôw, wôn, fôr, nôt, dq; cûre, bît, rÿde, fÿll, bûrn; out;

safety deposit vaults B 50-1 picture B 43
savings banks or departments B 43
insurance sold 1 170
school banks T 125-6
small loan departments or institutions B 52-3
state banks B 50 52
trust and savings banks T 201-2
trust companies T 201-2
trust department B 51
Bankside theater district of London
England S 119-20 picture S 123
Banks Island Canadian Island in Arctic Ocean discovered by Parry 1819 named for Sir Joseph Banks maps C 58 N 250
Banks of Newfoundland See (i) Index Newfoundland Banks
Bank swallow S 458
Banker Benjamin (1791-1806)
Agnostic astronomer naturalist and author born near Balt more of freed Negro slave parents published accurate almanacs built first striking clock in America discovered the 17 year cycle of locust plagues
Bannock or Bannak Shoshonean Indian tribe of n w plateau region of U S roamed s Idaho Oregon O 420
Bannock a kind of unleavened bread usually made with barley or oatmeal and cooked on a griddle common in early New England and the American frontier generally in Scotland B 284
Bannockburn village in Scotland 2 1/2 mi se of Stirling on the Bannock an affluent of the Forth map B 324 battle of (1314) B 332 F 59
Bannock Lewis May artist illustrator and author of children's books born near Traverse City Mich studied at Chicago Art Institute her travels in Mexico and Peru supply the background for some of her books (Manuela's Birthday Gregorio and the White Lama Billy and the Bear Big Brother)
Bann River Northern Ireland rises in Mourne Mts flows to Lough Neagh and then e n w into the Atlantic length about 90 mi s of Lough Neagh called Upper Bann n of Lough Neagh called Lower Bann
Banquo (bung'wō) Scottish thane in Shakespeare's Macbeth murdered by Macbeth his ghost appears at a royal feast
Ban shee in Celtic folklore a supernatural being who foretells the death of a member of a household by mournful screaming at night
Bantam (ba'tam) seaport of Java 80 mi w of Jakarta gave name to bantam fowls
Bantam (ba'tam) fowls F 403
Bantamwile in boying B 267
Banteng (bān'tēng) also banteng bantia or twaine (Bos sondaicus) cattle C 141
Banting Sir Frederick Grant (1891-1941) Canadian scientist B 53 picture B 53
Banting Research Foundation C 90
Bantock Sir Granville (1868-1946) English composer colorful orchestration (Alalanta in Calydon)
Bantay Bay a w Ire and maps B 321 322
Bantu group of tribes in central east and south Africa A 43 S 242 244 M 442 T 10 R 1440 map A 39 picture F 444
Banya Basil mosque Sofia Bulgaria, picture B 349
Banyan tree B 53 4 picture B 54
Baobab (ba'ō bāb) or monkey bread tree T 173 184

Bao Dai (bā dāi) (born 1913) chief of state formerly emperor of Viet Nam Indo China 1 123
Bapt John (1815-87) Jesuit missionary born La Roche Switzerland ministered to Indians and others in Maine (1848-54) until exiled by Know Nothing party rector of Boston College 1859-69
Baptisia (bāp'tizē) or false indigo a genus of perennial plants of the pea family leaves divided into 3 leaflets flowers yellow blue or white in clusters
Baptism a ceremony by which one becomes a Christian
Anabaptist view F 443
church sacrament C 302
of Jesus J 340
Baptistery portion of a church or separate building used for baptisms Florence I 279 F 147 picture F 147
Chesters doors G 107 I 279
B 380 picture F 195
Baptist F 272 picture I 279
Baptists Protestant denomination who maintain that baptism should be administered to believers only and by immersion for membership see in Index Religion table
Baptists in England P 413
United States C 303 W 140
Baptist Young Peoples Union of America an organization formed in 1891 by the federation of Baptist young people's societies in U S and Canada object is unification and religious development
BAR (Brownline Automatic Rifle) F 80 picture F 78
Bar in law the court, or lawyers authorized to appear before the court from the bar or railing which separates judge from prisoners hence the expression to plead before the bar in England lawyers are called barristers
Bar in music See in Index Music table of musical terms and forms
Bar in physics pressure exerted by a force of 1,000,000 dynes on a square centimeter of surface equivalent to pressure exerted by a column of mercury .953 in high See also 4 1 1 dex Dyne
Barabas (bā'ō bās) Christopher Marlowe's character The Jew of Malta an avaricious murderous monster type humanized by Shakespeare into Shylock
Barab has a robber released by Pilate on demand of Jews when Jesus was condemned
Baraboo W's city on Baraboo River 3 1/2 mi n w of Madison map 7284
woolen products playground equipment map W 173
Ring circus C 312
Barada (bā'rādā) small river of Syria flowing through Damascus supposedly the Abana of the Bible agricultural products D 12
Baranof (bā'rānōf) Island one of chief islands of Aleutian Archipelago Alaska 100 mi long tongue of Ska on w coast
Baranof (bā'rānōf) Robert (1876-1936) Austrian physician Nobel prize in medicine (1914) for improvements in methods of diagnosis after 1916 professor at University of Uppsala
Barat (bā'rāt) Madeleine Sophie Saint (1779-1865) founder of the Society of the Sacred Heart born Society of the Sacred Heart the Joigny Burgundy France the Society founded in 1860 received papal approbation in 1877 canonized 1925 feast day May 15
Barat C heg of the Sacred Heart at Lake Forest Ill Roman Catholic

for women founded 1804 arts and sciences
Barataria (bā'rātārā) Bay La., on Gulf of Mexico w side of Mississippi delta headquarters in early 19th century of notorious band of pirates map L 331
Baratta (bā'rātā) Francesco (died 1656) Italian sculptor pupil and follower of Berni best work fountain in Piazza Navona Rome also did the high altar in church of San Nicola di Tolentino in Rome
Barb a breed of light horses introduced by the Moors into Spain from Barbary noted for speed and endurance H 428 note H 428
Barb any of several species of tropical fish belonging to family Cyprinidae color picture F 194
Barb pigeon F 254
Barbados (bā'r-bādō) island of British West Indies 166 sq mi pop 192,800 cap Bridgetown B 84 maps W 96a C 252
pe picture W 96
Barbara (bā'r-barā) virgin martyred by order of her father a heathen who was struck by lightning as punishment protectress in thunderstorms and patroness of art, hermen and miners feast day December 4
Barbara Fritchle See in Index Fritchle Barbara
Barbarosa (bā'r-bōr-sā) name given by Greeks to all people who did not speak Greek primarily to express the strangeness of the foreign languages later used by Pomani to designate all people except Greeks and Pomani finally came to mean uncivilized brutal or crude persons
Barbarism a state of society between savagery and civilization C 325
Barbarossa (bā'r-bōr-sā) red beard nickname for Frederick I (1155-90) Holy Roman emperor F 281
Barbarossa Khatir ed Din Turkish corsair who terrorized Mediterranean seacoast in 16th century
Barbary Coast name given to a once notorious district in San Francisco bordering San Francisco Bay in area around slopes of Telegraph Hill thrived from gold rush of 1849 until 1917
Barbery steep or audacious S 136
Barbery States region of n Africa named from Berbers original inhabitants includes Morocco Algeria Tunisia Libya map A 187
Moors in M 189
pirates F 272 M 394 Blake and B 205 Cervantes captured by C 179 Decatur's expedition D 28 Tunisia T 297 United States Navy and N 82
Barbauld (bā'r-bōld) Anna Letitia (1743-1823) English author now chiefly remembered for religious poems simple in feeling and style (Hymns in Prose Evenings at Home with her brother Dr John Akin Ode to Life)
Barbeau (Charles) Marius (born 1883) Canadian ethnologist and folklorist born Ste Marie de Beauce near Quebec Canada (Folk Songs of Old Quebec Alaska Beckons Mountain Cloud)
Barbecue outdoor feast where animals are roasted whole formerly common in s w U S term applied also to the process of such roasting traces of the custom seen in some restaurants and in barbecue stands along highways term

* French or German * gem so thin then = French nasal (Jea) sh = French ; (s in azure) k = German guttural ch

- now popularly used to designate outdoor cookery.
- Barbed wire** W-163
- use in warfare W-163, W-222
- Barbel**, soft, slender "feeler" around mouth of certain fishes, such as catfish, cod, drumfish, goatfish, sturgeon: F-103, pictures A-250c, F-101
- Barbellion** (*bār-bēl'yōn*), W. N. P., pen name of Bruce Frederick Cummings (1889-1919), English diarist and scientist ('Journal of a Disappointed Man'; 'Enjoying Life and Other Literary Remains of W. N. P. Barbellion'; 'A Last Diary').
- Barber**, John, inventor of a gas engine I-186
- Barber**, Samuel (born 1910), composer, born West Chester, Pa.; began to compose at age of 7; awarded American Prix de Rome (1935), Pulitzer prize (1935, 1936), Post Service Fellowship from Guggenheim Memorial Foundation ('Music for a Scene from Shelly', 'Symphony in One Movement', 'Adagio for Strings', 'Essay for Orchestra')
- Barber** (from Latin *barba*, "beard"), one who cuts or dresses hair, trims and shaves beards
- medieval barber-surgeons A-239
- Barberini** (*bār-bā-rē'nē*), powerful Italian family in 16th and 17th centuries; Maffeo (Pope Urban VIII) most famous member, great palace in Rome symbol of their wealth, allied by marriage to Colonna family.
- Barberini Palace**, in Rome, Italy R-195
- 'Barber of Seville, The'**, opera by Rossini
- story O-389
- Barberry**, an ornamental shrub H-329
- harbors wheat rust R-297, 299, picture R-298
- Barberry family**, or *Berberidaceae* (*bār-bēr-i-dā'sē-ē*), a family of plants and shrubs, native to Europe, Asia, and the Americas, including the common barberry, mahonia, and May apple.
- Barber-Scott College**, at Concord, N.C., for women; Presbyterian; founded 1867; arts and sciences.
- Barber's pole**, origin A-239
- Barderton**, Ohio, manufacturing city 7 mi. s. of Akron on Ohio Canal; pop. 27,820; matches, match machinery: map O-356
- Barbey d'Aurevilly** (*bār-bā' dōr-rē-yē'*), Jules Amédée (1808-89), French writer, born France (short stories, 'Les Diaboliques'—English translation, 'Weird Women').
- Barbirolli** (*bār-bē-rōl'ē*), Sir John (born 1899), musical conductor, born London, England, of Italian and French parents; debut as cellist 1911; conductor British orchestras, New York Philharmonic-Symphony 1937-43, Hallé Orchestra, Manchester, England, from 1943.
- Barbital**, a narcotic drug N-13
- Barbiturates** (*bār-bi-tū'rāts*), drugs N-13, A-246
- Barbituric** (*bār-bi-tūr'ik*) acid N-13
- Barbizon** (*bār-bē'zōn'*) school, in painting P-38, M-255
- Corot C-487
- Millet M-255
- Barbour**, John (1316?-95?), Scottish poet, distinguished for vigorous style; wrote national epic ('The Brus') about Robert Bruce.
- Barbour**, Ralph Henry (1870-1944), writer of boys' books, born Cambridge, Mass.; wrote early stories and poems under pen name Richard Stillman Powell; pleaded cause of clean interscholastic sports; with LaMar Sarra, wrote 'Football Plays for Boys'; 'How to Play Better Basketball'; 'How to Play Better Baseball'.
- Barbuda** (*bār-by'dā*), one of Leeward Islands in British West Indies; 62 sq. mi.; pop. 979; about 250 mi. s.e. of Puerto Rico: map W-96a
- Barbusse** (*bār-būs'*), Henri (1874-1935), French novelist and journalist; served in World War I; much of his work propaganda for social and political reform ('Under Fire', portrayal of horrors of war).
- Barcarole**. See in *Index* Music, table of musical terms and forms
- Barcelona** (*bār-sē-lō'ng*, Spanish *bār-thā-lō'nā*), seaport and chief manufacturing center of Spain; pop. 1,260,179, with suburbs: B-54-5, maps S-312, E-425, pictures B-54-5, S-319
- Bar chart** G-158-9, G-161-2, charts G-158, 161
- Bar'clay**, Alexander (1475?-1552), British poet, scholar, and divine ('The Ship of Fools', English adaptation in verse of German satire, 'Das Narrenschiff' by Sebastian Brant, 'The Eclogues', earliest pastoral poems in English).
- Barclay**, Robert (1648-90), famous Scottish apologist of Quakers, defended doctrine that divine truth is made known through intuition, not logic ('An Apology for the True Christian Divinity').
- Barco** oil field, in Colombia C-388
- Barcoo River**, Australia. See in *Index* Cooper's Creek
- Bard College**, formerly St Stephen's College, at Annandale-on-Hudson, N. Y.; founded 1860, liberal arts; historical association with Protestant Episcopal church.
- Bardell**, Mrs., widow in Charles Dickens' 'Pickwick Papers', plaintiff in case of Bardell v. Pickwick; teaches Mr. Pickwick to "beware of vidders."
- Bardia**, town in Libya L-219
- Bards**, name given to poetic singers among the Celtic peoples, especially in Ireland and Wales; composed verses in honor of heroes and sang them at festivals; term now applied loosely to any poet
- Welsh eisteddfod M-460
- Bardstown**, Ky., historical town 20 mi. s.e. of Louisville; pop. 4154; map K-50
- Foster shrine F-248, picture K-34
- Barbone's Parliament**, in England E-366, 367
- 'Barefoot Boy, The'**, poem by Whittier W-132, A-226d
- Bareilly**, or Bareil (*bā-rā'li*), India, trade center in Uttar Pradesh state, 150 mi. s.e. of Delhi; pop. 208,082; massacre of Europeans in mutiny of 1857: map A-407
- Bar'ents**, Willem (died 1597), Dutch explorer; discovered Spitsbergen, explored Novaya Zemlya and Bar'ents Sea.
- Bar'ents Sea**, part of Arctic Ocean n. of Norway and Russia between Svalbard and Novaya Zemlya: map A-406. See also in *Index* Ocean, table
- Barfleur** (*bār-flūr*), a small seaport and summer resort of n.w. France, 15 mi. e. of Cherbourg; important port in Middle Ages
- Barfurush**, Iran. See in *Index* Babol
- Bargaining**, collective. See in *Index* Labor unions, subhead collective bargaining
- Barge**, cargo, pictures E-421, M-309, M-322, R-133, I-29
- Bargone**, Charles. See in *Index* Farrère, Claude
- Bar'ham**, Richard Harris (1788-1845), pseudonym Thomas Ingoldsby, English humorist, born Canterbury ('Ingoldsby Legends', tales in verse).
- Bar Harbor**, Me., summer resort; headquarters of Acadia National Park; resident pop. of township, 3864; M-55, map M-53
- Bari** (*bā'rē*), seaport in s.e. Italy on Adriatic; pop. 267,726; ancient Barium; several old churches; extensive commerce and manufactures: maps I-262, E-425
- Baring**, family of English bankers; firm Baring Brothers, established by Sir Francis (1740-1810) and his brother John became one of the great international banking houses of the world; many of family in public life. See also in *Index* Ashburton; Cromer; Revelstoke
- Baring**, Maurice (1874-1945), English writer; son of first Baron Revelstoke; war correspondent in Russo-Japanese and Balkan wars; served in Air Force in World War I ('Dead Letters', 'Diminutive Dramas', 'The Puppet Show of Memory', 'When They Love', 'The Coat Without Seam', 'Robert Peckham'—novels; poems; translations).
- Baring-Gould**, Sabine (1834-1924), English clergyman and writer; novels ('John Herring', 'Melalah'), interesting works on religion, superstitions, and folklore ('Curious Myths of the Middle Ages'), books of travel and history, and many hymns ('Onward Christian Soldiers', 'Now the Day Is Over').
- Barisan Mountains**, in Sumatra S-449
- Barite** (*bēr'it*), or barytes (*bā-rī'tē*), a heavy crystalline mineral (barium sulfate), white or of varying colors; used in barium chemicals, and in manufacture of explosives; shade cloth, rubber tires, also in muds used to facilitate drilling into sand and gravel: A-168
- Arkansas A-360
- mineral form M-265
- Nova Scotia N-308
- paint extender P-40
- Baritone**, or barytone, in music the male voice having a range higher than bass and lower than tenor: diagram M-468b
- Barium**, an alkaline earth chemical element A-168, tables P-151, C-214
- chromate forms pigment C-300-1
- electrochemical activity E-315
- formed from uranium-235 A-466, diagram A-465
- glassmaking G-121
- sulfate. See in *Index* Barite
- sulfide, phosphorescent properties P-208
- X-ray diagnosis uses compounds of X-330
- Bark**, of shrubs and trees B-55. See also in *Index* names of various trees
- uses R-55, W-143; canoes B-155, C-114, pictures C-113, I-102; cork C-479-80, pictures C-479; paper M-446; quinine Q-14; spices S-339, 340; tanning L-147-8; tapa cloth M-446
- Bark**, or barque, a sailing vessel S-151
- Bark'antine**, also barkentine, a sailing vessel S-151, picture S-153
- Barker**, Eugene Campbell (born 1874), historian, born near Riverside, Tex.; professor of American history at University of Texas since 1912 ('Life of Stephen F. Austin', 'The Austin Papers 1765-1836', with H. E. Bolton, 'Growth of a Nation').
- Barker**, Harley Granville. See in *Index* Granville-Barker
- Barker**, carnival C-126, picture C-125
- Barking deer**, or muntjac D-45
- 'Barking sands'** S-58

Key: cape, āt, fār, fāst, what, fāl; mē, yēt, fērn, thēre; ice, bit; rōw, wōn, fōr, nōt, dō; cūre, bīt, rīde, fūll, bār'n; out;

"Barkis is willin'." the famous mes-
sage sent by the shy carrier in
Charles Dickens' David Copper-
field to Peggoty David's nurse
whom he wants to marry

Barkla, Charles Glover (1877-1944)
British scientist Nobel prize in
physics (1917) for work on electric
rays and X rays

Barkley, Alben William (born 1877)
lawyer and public official born
Graves County Ky., member of U S
House of Representatives 1913-27
senator from Kentucky 1927-49 and
since 1930 majority leader of Sen-
ate 1937-46 vice president of U S
1949-53 picture U 394

Barkly Tableland in N Australia n
part of Northern Territory maps
A 438 478

Barkach (bar'lon) Ernst (1870-1938)
German sculptor and playwright
known for expressive wood carvings
of peasants and wanderers

Bar-le-Duc (bar'le d'uk) France a
quaint old town 125 mi e of Paris
pop 14 010 noted for currant jam

Barlee (bar'lee) Lake in W Western
Australia maps A 438 478

Barley B 55-6 picture B 55
barleycorn used as unit of measure
V 162 V 86
chinch bug attacks C 287
malt M 60
rusts and smuts R 297-9 picture
R 297

Barleycorn John personification of
intoxicating liquors

Barleycorn unit of measure V 86
S 162

Barley sugar S 447

Barlow Howard (born 1892) orches-
tra conductor born Plain Ct.
Oh o one of leading conductors of
radio programs conductor Balti-
more Symphony Orchestra

Barlow Joel (1754-1812) poet and
medical leader born Rejding
Conn champion during Peabody
thiatory War minister to France
1811 went to Poland for conference
with Napoleon and died of exposure
when caught in retreat of French
army from Moscow wrote epic
"The Vision of Columbus" ("The
Columbiad") in pompous classical
style Hasty Pudding mock heroic
still readable A 226a

Barmede (bar'med'id) Persian
family powerful under early Abba-
sid caliphs (8th century) Bar-
mede's feast meaning an imaginary
banquet comes from The Arabian
Nights where a Barmede's feast
at a hungry man's expense by
placing empty dishes before him

Barabas fellow laborer with the
Apostle Paul his epistle is one of
the apocryphal books of the New
Testament commemorated as saint
June 16

Barbary Ridge novel by Dickens
(1841) based on the Gordon riots
of 1789 D 84

Barbatic marine crustacean B 56 pic-
tures B 56 A 200a
paints prevent P 41
while barbatic color pictures S 139

Barbatic goose a wild goose (*Branta
leucophaea*) found around n seas
especially in Europe and Green-
land fabled to have developed
from a barnacle

Barbard Edward Emerson (1857-
1923) astronomer born Nashville
Tenn astronomer Lick Observa-
tory 1887-90 Yerkes 1895-1923
Discovered 16 comets Jupiter's 5th
satellite and the star with greatest
known motion V 106

Barbard Frederick Augustus Porter
(1809-99) scientist and educator

born Sheffield Mass. president of
Columbia College (now Columbia
University) 1864-69 Barnard Col-
lege named in his honor

Barnard George Grey (1851-1938)
sculptor born Bellefonte Pa.
some of work outstanding for
grace and simplicity best known
for massive rugged and forceful
works founded The Cloisters
museum of French medieval art
now branch of Metropolitan Museum
of Art New York City S 81

Barnard Henry (1811-1906) Con-
ductor born Hartford Conn.
founder and editor of American
Journal of Education and first U S
commissioner of education E 255

Barnard College New York City for
women founded 1899 arts and
sciences part of Columbia Uni-
versity

Barnardo (bar'nard'o) Thomas John
(1845-1904) British philanthro-
pist founder of over 100 Barnardo
Homes which had sheltered a d
trained as many as 60 000 children
by the time of his death

Barnaul (bar'naul) capital of
Barnaul district in W Siberia on
Ob River and Turkestan Siberian
railroad ships farm products beet
sugar glass brick has mining
school and metallogical observa-
tory pop 2 000 maps A 405

Barnburner nickname of Democratic
faction in New York State 1844-
52 named for supposed zeal for
reform like the farmer who burned
his barn to rid it of rats
nominate Van Buren V 437

Barnby Sir Joseph (1838-96) Eng-
lish musical composer and con-
ductor (oratorio Rebekah an
them hymn tunes part songs
pieces for organ)

Barnes George Nicoll (1839-1940)
British labor leader engineer by
trade in House of Commons after
1896 minister of pensions 1916-
17 in war cabinet 1917-20 labor
representative at London Peace
Conference

Barnes Harry Elmer (born 1849)
educator and writer born Auburn
N Y lecturer at various American
universities professor historical
sociology Smith College ("The So-
cial History of the Western World
The Genesis of the World War
History of Western Civilization")

Barnes Howard Turner (born 1873)
Canadian scientist born Woburn
Mass professor physics Ernest
University succeeded by Ernest
Rutherford research on engineer-
ing problems relating to ice forma-
tion flowing water

Barnes Margaret Ayer (Mrs Cecil
Barnes) (born 1886) novelist and
playwright born Chicago Ill.
(Years of Grace a novel books
Pulitzer prize 1931 other stories
Prevailing Winds short stories
and Westward Passare a novel)

Barnveldt (bar'veldt) Jan van
Oliven (1417-1419) Dutch states-
man accused Twelve Years Truce
man with Spain 1609 unjustly beheaded
on a charge of treason

Barny Johnna (1759-1818) U S
Nav officer born Baltimore Md.
outstanding service in Revolution
ship captured by British ship
General Monk off Cape May 1782
General Monk's service 1790-1800
in French naval service in defense of Ches-
apeake Bay 1814

Barnhelm Minna von the clever gen-
erous heroine of Goethed Lessing's
comedy Minna von Barnhelm

Barn owl O 430 picture O 430 color
picture B 181

Barnstaple England a market and
manufacturing town in Yorkshire,
12 mi n of Sheffield pop 7 020
coal steel linen map B 325

Barn swallow S 458 picture S 459
color pictures B 167 185
nest, pictures S 173 S 459 color
picture B 167

Barnstaple name S 459

Barnum Phineas Taylor (1810-91)
American showman B 67 C-311-12,
picture B 57
gift to Eldridgeport B 312
Jumbo giant elephant C 312
Tom Thumb B 31

Barnum and Bailey Circus C 311-13
Barnyard mill M 255 256

Bareda (ba're'da) trade and rail-
road center in Bombay state W
Ind a 253 mi n of Bombay pop
211 477 formerly capital of
princely state of same name map
A 407

Barograph instrument which regis-
ters atmospheric pressure contin-
uously and graphically used by avi-
ators B 55

Baroja (ba'ro'ha) Pio (born 1872)
Spanish novelist honest and inde-
pendent writer vividly of his own
Basque country called Dickens
grown and nice ("Caesar or Noth-
ing The Quest Weeds") S 327

Barometer B 57-9 d agronomy B 58-9
picture W 81b

**Bar on title of nobility in Great Brit-
ain** Europe and Japan
in British peerage D 40 42

Baronet an inheritable title in Great
Britain ranking next below that
of baron the highest degree of
honor borne by commoners above
knight B 42

Barons Wars in England a rebellion
of nobles against Henry III led by
Simon de Montfort M 379

Baroness (ba'ron'ess) an baroness
(ba'ron'ess) the florid ornate style
characterizing fine arts in Europe
from middle 16th to middle 18th
centuries developed into gay ro-
coco style in France
architecture A 318 picture B 54
painting P 38
sculpture S 785-d picture S 78d

Baroque pearls pearls of irregular
shape P 107

Barre or bark a sailing vessel S 181

Barre Amelia Edith Huddleston (1831-
1919) American novelist born in
England the best of her 70 stories
deal with history of Scotland Eng-
land and Dutch New York ("How
of Orange P. blon Friend (ill. la.)

Barre Robert (1830-1912) Scottish
Canadian writer born Glasgow
Scotland A Woman Intervenes
Countess Trellick "The sword
dick" "The O'Ruddy" with
Stephen Crane

Barra (bar'p) island of Outer Heb-
rides about 8 mi long and 2 to 5
n wide pop about 7000 chief
town Castlebay a fishing center
H 327 map B 324

Barrahan (bar'ra'han) fabric of the
Levant also a robe of this fabric
S 16

Barack emperors in Roman history
name given by historians to the
succession of Poman emperors
placed in power by the army from
reign of Septimius Severus to ac-
cession of Diocletian (A.D. 193-284)
P 185

Barabanda (bar'a'ly'nda) a large v
clous p ke-shaped fish B 59 60

Barraze (ba'ra'ze) a barrier of

artillery fire, mines, balloons, or other obstacles to enemy advance
balloon B-30, 36, picture B-31
submarine mine T-157

Barrage (*bār'ij*), type of dam D-10,
Jinnah barrage P-42b
Kotri barrage P-42b

Lloyd Barrage I-128, I-252
Nile E-272

Barramunda (*bār-a-mūn'da*), a lungfish, native to Australia M-445

Barranquilla (*bar-rān-kē'yā*), seaport of Colombia on Magdalena River 7 mi. from mouth; pop. 279,000; exports coffee, hides; produces textiles shoes, lumber, flour; C-388, maps C-387, S-252

Barras (*bā-ras'*), Paul François Jean Nicolas, vicomte de (1755-1829), French revolutionist; active in Robespierre's overthrow; became member of French Directory 1795, dictator 1797; retired 1799.

Barré (*bā-rā'*), Isaac (1726-1802), British political leader, born Dublin, Ireland; colonel in British army; opposed taxing of American Colonies; Barre, Vt. Barre Mass., and Wilkes-Barre, Pa., named for him.

Barre (*bār'ē*), Vt., city in n. center 5 mi. s.e. of Montpelier; pop. 10,922; V-461, map V-457

granite quarry, picture V-460

Barred owl O-430-1, picture O-430

Barrel, unit of measure or weight; U.S. standard barrel for vegetables and fruits (except cranberries) holds 7056 cu in., that for cranberries, 5826 cu in.; U.S. barrel for petroleum holds 42 U.S. gallons; English barrel for beer, 43.23 U.S. gallons; U.S. barrel for beef and pork, 200 lb.

liquid measure, table W-87

weights, table W-89

Barrel cactus A-346

Barrel knot, also blood knot, picture F-118e

Barrel pen P-116

Barrel roll. See in Index Aviation, table of terms

Barren Ground caribou C-122

migration M-243, map M-241

Barren Lands, vast treeless plains or tundras in n. Canada C-78, L-137

Barrès (*bā-rēs'*), Maurice (1862-1923), French author and political leader; developed from aristocratic dilettante and agnostic into strong nationalist and defender of Roman Catholic church; fine, polished style ('Faith of France'; 'War and the Spirit of Youth'; 'Sacred Hill'); F-289

chief works F-290

Barrett, John (1866-1938), diplomat, born Grafton, Vt.; director general of Pan American Union 1907-20.

Barrett, Lawrence (1838-91), Shakespearean actor, born Paterson, N.J.; long associated with Edwin Booth; notable for his Cassius.

Barrias (*bā-rē-ds'*), Louis Ernest (1841-1905), French sculptor; classic spirit ('First Burial'; 'Joan of Arc as a Prisoner')

'The Boy Mozart', picture M-443

Barrie, Sir James Matthew (1860-1937), Scottish novelist and dramatist B-60, E-382b

'Peter Pan' R-60: Maude Adams in, picture D-133

statue of Peter Pan, picture B-60

Barrie, Ontario, Canada, city and summer resort on Lake Simcoe, about 60 mi. n. of Toronto; pop. 12,514; building materials, flour, boilers, textiles, shoes; map C-72

Barrier Islands E-184

Barrier reefs, formed by corals C-478

Great Barrier Reef A-476, C-478, maps A-478, 489, pictures C-477

Barrington, L. See in Index Beck, L. Adams

Barron, James (1769-1851), commodore, born in Virginia; in command of *Chesapeake* when attacked by British *Leopard*
Chesapeake affair W-11
killed Decatur D-28

Barrow, Isaac (1630-77), English mathematician and theologian, born London; first Lucasian professor of mathematics, Cambridge University 1663; in 1669 resigned in favor of pupil Isaac Newton; credited with preparing way for differential calculus ('Lectiones Opticae et Geometricae').

Barrow, Sir John (1764-1848), English traveler and writer; secretary to the British Admiralty 1804-15; did much to promote Arctic exploration ('Travels in China').

Barrow in Farness, England, seaport in Lancashire 50 mi. n.w. of Liverpool; pop. 67,467; iron mines; steelworks, shipyards; map B-325

Barrow River, 2d largest river of Ireland, in s.e.; flows e. and s. 120 mi. to Atlantic near Waterford; map B-325

Barrows, David Prescott (1873-1954), educator, born Chicago, Ill.; director of education, Philippines; president, University of California, retiring in 1923; lieutenant colonel 1919; major general California National Guard ('History of the Philippines').

Barry, Sir Charles (1795-1860), English architect, born London; King Edward's Grammar School, Birmingham, considered finest work

Houses of Parliament L-304

Barry, John (1745?-1803), American naval hero B-60-1, picture B-61

Barry, Marie Bégué, countess du. See in Index Du Barry

Barry, Phillip (1896-1949), playwright, born Rochester, N. Y.; well-constructed plays usually about society people; clever dialogue ('White Wings'; 'Paris Bound'; 'Holiday'; 'Hotel Universe'; 'Tomorrow and Tomorrow'; 'The Animal Kingdom'; 'Philadelphia Story').

Barry College for Women, at Miami, Fla.; Roman Catholic; founded 1940; arts and sciences.

'Barry Lyndon', novel by Thackeray T-108

Barrymore, Ethel (born 1879), actress (stage, screen, radio, and television), born Philadelphia, Pa.; made debut in 1896 in company of her uncle, John Drew; married Russell G. Colt, divorced 1923; stage plays: 'Captain Jinks', 'Alice-Sit-by-the-Fire', 'The Constant Wife', 'The Corn Is Green'; autobiography: 'Memories'.

Barrymore, Georgiana Emma Drew (1856-93), American actress, wife of Maurice Barrymore and mother of Lionel, Ethel, and John; versatile actress; appeared in plays with husband, also with Edwin Booth; did notable work in 'The School for Scandal', 'L'Abbé Constantin', and 'The Wages of Sin'.

Barrymore, John (1882-1942), actor, born Philadelphia, Pa.; brother of Ethel and Lionel; made debut in 1903 in 'Magda'; later appeared in 'The Fortune Hunter'; 'Are You a Mason?'; 'Peter Ibbetson'; 'Redemption'; 'The Jest'; 'Richard III'; 'Hamlet'; also famed motion-picture actor ('Don Juan'; 'Beau Brummel'; 'Svengali') in 'Justice', picture D-135

Barrymore, Lionel (1878-1954), stage, screen, radio, and television actor,

born Philadelphia, Pa.; brother of Ethel and John ('The Jest'; 'The Copperhead'; 'The Claw'; 'Laugh, Clown, Laugh').

Barrymore, Maurice, real name Herbert Blythe (1847-1905), English actor, father of Ethel, John, and Lionel; leading man for Mme. Modjeska, Mrs. Langtry, Olga Nethersole, Mrs. Fiske.

Bar-sur-Seine (*bār-sūr-sēn'*), historic town of e. France, on Seine River, 20 mi. s.e. of Troyes; pop. 1875; devastated 1359 by English.

Barter, exchange of articles without use of money M-336

Aztec A-543

Bedouins in Arabia A-286

Brazil, picture A-185

Congo basin C-434b

fur trade F-322, 323

International I-196, F-235

modern co-operatives C-470

Mongolia M-343

pioneer America P-263, W-23

Barter agreements, in foreign trade I-196

Barth (*bärt*), Heinrich (1821-65), German explorer; published book on travels and discoveries in Africa.

Barthe, Richmond (born 1901), Negro sculptor, born Bay St. Louis, Miss.; work shows original and vigorous realism; many of his pieces in Whitney Museum, New York City, and in U. S. government buildings.

Barthelemy, Peter, a priest in the First Crusade C-519

Bartholdi (*bār-tōl-dē'*), Frédéric-Auguste (1834-1904), French sculptor B-61, picture B-61

'Lion of Belfort' B-61, picture B-61
Statue of Liberty L-179, pictures L-179

Bartholomé (*bār-tō-lō-mā'*), Albert (1848-1928), French sculptor; designed Croix de Guerre medal; noted for group 'To the Dead' at Père Lachaise Cemetery in Paris.
Bartholomew (*bār-thō-lō-mū*), saint, one of Twelve Apostles; festival August 24; A-275

fair F-12

massacre of St. Bartholomew's Day C-194, C-382, H-442

Barthou (*bār-to'*), Loui's Jean (1862-1934), French statesman and writer; foreign minister 1934; assassinated Oct. 9, 1934, with King Alexander of Yugoslavia ('Mirabeau'; 'Le Général Hugo').

Bartlesville, Okla., city in n.e., in Mid-Continent oil field; pop. 19,228; office headquarters for oil firms; oil research laboratories; zinc processing; pumps; map O-371

Bartlett, John (1820-1905), editor and publisher, born Plymouth, Mass. ('Familiar Quotations', nine editions in his lifetime; 'Concordance to Shakespeare').

Bartlett, Josiah (1729-95), signer of Declaration of Independence; born Amesbury, Mass.; president of New Hampshire 1790-93; elected governor 1793

signature reproduced D-37

Bartlett, Paul Wayland (1865-1925), sculptor, born New Haven, Conn.; first did animal sculpture; portrait statues of Lafayette and Franklin; six heroic figures for entrance New York Public Library; statues of Columbus and Michelangelo in Congressional Library; S-81

Bartlett, Robert Abram (1875-1946), American navigator, known for many Arctic explorations; born Briggs, Newfoundland; commanded the *Roosvelt* on Peary's Arctic expeditions 1905-6 and 1908-9, on the latter sailing to 82° 30' n. and proceeding thence on land to 87° 46' 49"

Key: cape, dt, fār, fāst, whqt, fgl; mē, yēt, fērn, thēre; ice, bit; rōw, wōn, fōr, nōt, do; cūre, būt, ryde, fyll, būrn; out;

n from which Peary went by sledge to North Pole (Last Voyage of the *Baruk* Log of Bob Bartlett)

Bartlett Dam in Arizona on Verde River A 346 map C 414b picture D 8 See also in Index Dam table

Bartlett pear P 107

Bartlett's elm P 322

Bartók Béla (bar tók) (1881-1945) Hungarian composer used Hungarian folk music and traditional melodies but his style is strongly modern (opera *Bluebeard* dance poems *Wooden Prince* *The Wonderful Mandarin*)

Bartolommeo (bar tó lóm mē) Fra (1472-1517) painter of the Florentine Renaissance adherent of Savonarola after whose death he became Dominican monk excelled in composition

Bartolozzi (bar tó ló tē) Francesco 1727-1815 Italian engraver born Florence lived nearly 40 years in London from 1803 on was head of Royal Academy at Lisbon Portugal skilful line and stipple work

Bart n n (born 1888) writer of popular philosophy son of William F. Barton born Robbins Tenn. U.S. representative 1937-41 (More Power to You The Man Nobody Knows The Book Nobody Knows)

Barton Clara (1871-1912) 1st president American Red Cross B 62 picture B 62

Barton Davil (1783-1857) political leader born Green Co. Tenn. president Missouri Constitutional Convention (1820) one of first two U.S. senators from Missouri (1841-51)

Barton Sir Edmund (1849-1908) first prime minister of Australian Commonwealth 1901-03

Barton Otis (born 1897) explorer born New York City a theorist of "The World Beneath the Sea" deep-sea exploration O 328 picture E 466

Barton William Eleazar (1861-1939) clergyman and writer father of Bruce Barton born Sublette Ill. pastor First Congregational Church Oak Park Ill. 1899-1924 authority on Lincoln (Life of Lincoln The Great Good Man—young folks life of Lincoln)

Bartula a small much branched annual garden herb (M. fasciculata) with small grayish dentate leaves and large saucer-shaped 5-petaled fragrant yellow flowers

Bartum John (1699-1777) father of American botany born Chester County Pa. P 129-40

Batrachian sandpiper See in Index Upland plover

Bauch (bauch) Bernard Hannes (born 1876) American financier B 62 picture B 62

atomic control plan U 249b

Bauch apocryphal book of Old Testament B 136

Bary Heinrich Anton de See in Index De Bary

Barre (bā rē) Antoine Louis (1796-1875) French sculptor S 79 80 Art Riding a Gnu picture S 79

Barry See in Index Barrie

Barryone See in Index Baritone

Basal metabolism See in Index Metabolism

Basalt a fine grained heavy igneous rock often solidified into prismatic columns M 286 L 138 picture L 231 cliffs in Washington color picture U 300

Basal cave C 158 Geological classification See in Index Rock table

Basalt was a wedgwood pottery P 397

Basaltite See in Index Touchstone

BASEBALL PENNANT AND WORLD SERIES WINNERS

| NATIONAL LEAGUE | AMERICAN LEAGUE | WORLD SERIES* |
|-------------------|-----------------|---------------------|
| 1903 P.burgh | Boston | Boston (5-3) |
| 1905 New York | Philadelphia | New York (4-1) |
| 1906 Chicago | Chicago | Chicago A L (4-2) |
| 1907 Cincinnati | Detroit | Chicago (4-0) |
| 1908 Cincinnati | Detroit | Chicago (4-1) |
| 1909 Pittsburgh | Detroit | Pittsburgh (4-3) |
| 1910 Chicago | Philadelphia | Philadelphia (4-1) |
| 1911 New York | Philadelphia | Philadelphia (3-2) |
| 1912 New York | Boston | Boston (4-3) |
| 1913 New York | Philadelphia | Philadelphia (4-1) |
| 1914 Boston | Philadelphia | Boston (4-0) |
| 1915 Philadelphia | Boston | Boston (4-1) |
| 1916 Brooklyn | Boston | Illon (4-1) |
| 1917 New York | Chicago | Chicago (4-2) |
| 1918 Chicago | Boston | Boston (4-2) |
| 1919 Cincinnati | Chicago | Cincinnati (5-3) |
| 1920 Brooklyn | Cleveland | Cleveland (5-2) |
| 1921 New York | New York | New York N L (5-3) |
| 1922 New York | New York | New York N L (4-0) |
| 1923 New York | New York | New York A L (4-2) |
| 1924 New York | Washington | Washington (4-3) |
| 1925 Philadelphia | Washington | Pittsburgh (3-3) |
| 1926 St. Louis | St. Louis | St. Louis (4-3) |
| 1927 Philadelphia | New York | New York (4-0) |
| 1928 St. Louis | New York | Philadelphia (4-1) |
| 1929 Chicago | Philadelphia | Philadelphia (4-2) |
| 1930 St. Louis | Philadelphia | St. Louis (4-3) |
| 1931 St. Louis | Philadelphia | New York (4-0) |
| 1932 Chicago | Washington | New York (4-1) |
| 1933 New York | Detroit | St. Louis (4-3) |
| 1934 St. Louis | Detroit | New York A L (4-2) |
| 1935 Chicago | New York | New York A L (4-1) |
| 1936 New York | New York | New York (4-0) |
| 1937 New York | New York | New York (4-0) |
| 1938 Cincinnati | Detroit | Cincinnati (4-3) |
| 1939 Cincinnati | New York | New York (4-1) |
| 1940 Brooklyn | New York | New York (4-1) |
| 1941 St. Louis | New York | St. Louis (4-1) |
| 1942 St. Louis | New York | New York (4-1) |
| 1943 St. Louis | St. Louis | St. Louis A L (4-2) |
| 1944 Chicago | Detroit | Detroit (4-3) |
| 1945 St. Louis | Boston | St. Louis (4-3) |
| 1946 Brooklyn | New York | New York (4-2) |
| 1947 Boston | Cleveland | Cleveland (4-2) |
| 1948 Brooklyn | New York | New York (4-1) |
| 1949 Philadelphia | New York | New York (4-0) |
| 1950 Brooklyn | New York | New York A L (4-2) |
| 1951 New York | New York | New York (4-3) |
| 1952 Brooklyn | New York | New York (4-2) |
| 1953 Brooklyn | Cleveland | New York (4-0) |
| 1954 New York | | |

* Number of games won and lost

† In 1904 New York N L refused to play Boston A L.

Bascule (bā skul) bridges B 308 picture B 309 311 See also in Index Bridge table

Base in chemistry A 9-10 C 217

bas c lava L 138 concentrations and equilibria C 219 electrochemical definition L 316 formed by metal M 176

Base of geometric figure M 150

Baseball B 63 72 picture B 63 72 amateur picture P 88b

Baseball Hall of Fame and Museum National B 70 See also table on following pages

bats made of ash A 461

batting average how to figure P 144b

books about B 72 H 391

Chicago F. P. picture C 268

leagues for young players B 70

tele is on broadcast P 17 T 50

world series B 63 70 See also table on following pages

Baseball Hall of Fame and Museum National B 70 See also table on following pages

players first five selected for picture B 64-6

Basenod (bā zē dō) or Basenod Jo

Iann Bernhard (1773-90) German educational reformer influenced by Rousseau taught 6000 on accord not to nature founded *Pflicht* (duty) in Dessau for training teachers ideas later carried out by more practical educators

Basel (bā zē) Basle or Bäle (bāi)

2d city of Switzerland trade center on Rhine near n. border pop 183

543 origins in a Gall. fortified town then frontier town of Romans prominent in Reformation

university founded 1460 silks chemicals S 479 maps S 475 E 425

Hohehn and F.asmus H 406

Basel Co. cell of (1431-39) C 302

Basel line in surveying S 457 L 92

Basel in family of Basle area (bā sē)

is 63 64 a family of n. ant. native to tropics includes Malabar night

shade Madras line and n.uro

Basen I (bā sē i) dog tail D 118

Base period in statistics S 385a

Bashan (bā shā n) rich district in an

u=French u German u gem go thin then n=French nasal (Jen:) sh=French (z in azure) k=German guttural ch

MEMBERS OF THE NATIONAL BASEBALL HALL OF FAME

(A.L., American League; N.L., National League)

Elected in 1936

Cobb, Tyrus Raymond (Ty) (born 1886), born Banks County, Ga.; outfielder Detroit, A.L., 1905-26; also Philadelphia, A.L., 1927-28; batting and base-running star; for 12 seasons, led American League in hitting; made record total of 4191 hits; created or equaled more records than any other player.

Johnson, Walter Perry (Barney) (1887-1946), born Humboldt, Kan.; pitcher Washington, A.L., 1907-27; called the greatest fastball pitcher in baseball history; won 414 games (2d highest total) for team that often finished in 2d division; set many strike-out and shutout records.

Mathewson, Christopher (Big Six)
(1880-1925), born Factoryville, Pa.;
pitcher New York, N.L., 1900-1916;
won 37 games in 1908, a modern league
record; won 30 or more games in each
of the seasons 1903-5; won total of 373
games; pitched 3 shutouts in 1905
world series.

Ruth, George Herman (Babe) (1895-1948), born Baltimore, Md.; pitcher then outfielder Boston, A.L., 1914-19, New York, A.L. 1920-34, and Boston, N.L., 1935; baseball's greatest home-run hitter and biggest drawing card.

Wagner, John Peter (Honus, or Hans) (born 1874), born Carnegie, Pa.; played chiefly the position of shortstop; player for Louisville, N.L., 1897-99 and for Pittsburgh, N.L., 1900-1917; often called "The Flying Dutchman," he was baseball's greatest shortstop and an outstanding hitter with an average of .300 or more for 17 consecutive seasons; scored more runs, made more hits, and stole more bases than any other National League player.

Elected in 1937

***Bulkeley, Morgan G.** (1837-1922), born East Haddam, Conn.; helped organize N.L. in 1876 and served as its 1st president.

*Johnson, Byron Bancroft (1864-1931), born Norwalk, Ohio; helped organize A.L. 1900; served as its 1st president 1901-27.

Lajoie, Napoleon (Larry) (born 1875), born Woonsocket, R.I.; second baseman chiefly Philadelphia, N.L., 1896-1900, and Cleveland, A.L., 1901-14; in 1901, batted .422, highest average in A. L. history; lifetime average .339.

McGillicuddy, Cornelius. *See* Mack,
Connie in this table.

*McGraw, John Joseph (Little Napoleon) (1873-1934), born Truxton, N.Y.; third baseman with 4 teams 1891-1905; gained chief fame as manager New York, N.L., 1902-32; won 10 pennants and 3 world championships.

Mack, Connie, real name Cornelius McGillicuddy (born 1862), born East Brookfield, Mass.; catcher 1886-96 but gained fame chiefly as manager Philadelphia, A.L., 1901-50; won 9 pennants and 5 world championships.

Speaker, Tristram E. (Spoke) (born 1853), born Hubbard City, Tex.; outfielder chiefly Boston, A.L., 1905-15, and Cleveland, A.L., 1916-26; one of outstanding center fielders and hitters in baseball history; played more than 100 games in each of 19 consecutive seasons; had lifetime batting average of .344; managed Cleveland 1919-26.

***Wright, George (1847-1937),** born New York, N.Y.; shortstop 1st professional team, Cincinnati Red Stockings, 1869-70, and Boston, N.L., 1871-78, 1880-82; noted chiefly as one of pioneer organizers of professional baseball.

Young, Denton True (Cy) (born 1857), born Gilmore, Ohio; pitcher Cleveland, N.L., 1890-98, St. Louis, N.L., 1899-1900, Boston, A.L., 1901-8, Cleveland, A.L., 1909-11, and Boston, N.L., 1911; won all-time record of 511 games pitched in major leagues, during 22 seasons, also a record; pitched 23 consecutive hitless innings 1904; pitched 3 no-hit, no-run games, including a perfect game (no batter reached first base) in 1905.

Elected in 1938

Alexander, Grover Cleveland (Pete)
(1887-1950), born St. Paul, Neb.;
pitcher Philadelphia 1911-17, 1930,
Chicago 1918-26, and St. Louis 1926-
30—all N.L.; one of all-time pitching
greats; set 7 pitching records; famous
for striking out Tony Lazzeri of New
York, A.L., with bases full in final crisis
of 1926 world series.

*Cartwright, Alexander Joy (1820-92), born New York, N.Y.; often called "father of modern baseball"; organized Knickerbockers of New York City in 1845 and pitched for that team 1845-48; established many playing rules still in effect.

***Chadwick, Henry** (1824-1905), born Exeter, England; pioneer baseball writer; invented the box score; author of 1st rule book (1858); chairman of rules committee National Baseball Association 1858-70.

Elected in 1939

*Anson, Adrian Constantine (Cap)
(1852-1922), born Marshalltown, Iowa;
first baseman Chicago, N.L., 1876-97;
batted 300 or more for 20 years; won 5
pennants as player-manager 1879-97.

Collins, Edward Trowbridge (Cocky)
(1887-1951), born Millerton, N.Y.; second baseman Philadelphia, A.L., 1906-14, 1927-30, and Chicago, A.L., 1915-26; batting and base-stealing star; Chicago manager 1925-26; vice-president Boston, A.L., 1933-51.

*Comiskey, Charles Albert (Old Roman) (1859-1931), born Chicago, Ill.; first baseman and manager with 6 teams 1882-04; pioneered modern first base defensive play away from the base; owner and president Chicago, A.L., 1900-1931.

***Cummings, William Arthur (Candy)**
(1848-1924), born Ware, Mass.; pitcher
with 7 teams 1866-78; invented the
curve ball in 1867.

*Ewing, William Buckingham (Buck)
(1859-1906), born Cincinnati, Ohio;
catcher chiefly New York, N.Y., 1883-
92; long-range hitter and splendid field
leader, called greatest catcher of 1890's.

Gehrig, Henry Louis (Iron Horse)
(1903-41), born New York, N.Y.; first baseman New York, A.L., 1923-39; game's most durable player, taking part in 2130 consecutive games; heavy hitter with a lifetime batting average of .340; played on 7 pennant-winning teams; hit 4 home runs in 1 game in 1932; batted in 154 runs in 1931, a league record.

Keeler, William H. (Wee Willie) (1872-1923), born Brooklyn, N.Y.; chiefly outfielder with 3 N.L. teams and 1 A.L. team 1892-1910; baseball's greatest scientific hitter; famed for his batting philosophy "Hit 'em where they ain't!" Hit safely in 44 consecutive games 1897.

***Raddbourne, Charles** (Old Hoss) (1853-97), born Rochester, N.Y.; pitcher Providence, N.L., 1881-85, Boston, N.L., 1886-90, and Cincinnati, N.L., 1891; greatest pitcher of 1890's; won 1884 pennant by pitching last 27 games of season, winning 26, for a total of 60, then won 3 straight in world series; won total of 308 games.

Sialer, George Harold (Gorgeous George) (born 1893) born Manchester, Ohio; first baseman, St. Louis, A.L., 1915-27, Washington, A.L., 1928, and Boston, N.L., 1928-30; hit safely in 41 consecutive games 1922; batted .420 in 1922; had lifetime average of .340; one of best fielders in baseball history.

*Spalding, Albert Goodwill (1850-1915), born Byron, Ill.; pitcher Boston N.L. (then National Association), 1871-75, and Chicago, N.L., 1876; first pitcher to win more than 200 games; president Chicago, N.L., 1882-91; organized baseball's 1st round-the-world tour 1888; with brother James organized sporting-goods business 1876.

None elected in 1940-41

Elected in 1942

Hornsby, Rogers (Rajah) (born 1896), born Winters, Tex.; second baseman St. Louis, N.L., 1915-26, 1933, New York, N.L., 1927, Boston, N.L., 1928, Chicago, N.L., 1929-32, and St. Louis, A.L., 1933-37; won league batting title 1920-25, 1928; hit .424 in 1924; had lifetime batting average of .355, second only to Ty Cobb's .357.

None elected in 1943

Elected in 1944

*Landis, Kenesaw Mountain (1866-1944), born Millville, Ohio; a federal judge who became baseball's 1st commissioner; served 1920-44; famous for his integrity and firm leadership.

Elected in 1945

***Bresnahan, Roger Phillip (Duke)**
(1879-1944), born Toledo, Ohio; catcher, also infielder, outfielder, and pitcher; played for Baltimore, A.L., 1901-2, New York, N.L., 1902-8, St. Louis, N.L., 1909-12, and Chicago, N.L., 1913-15; battery mate of Christy Mathewson with New York Giants; one of game's most gifted players.

***Brothers, Dennis (Dan) (1858-1932),** born Sylvan Lake, N.Y.; first baseman with 7 major league teams 1879-96; heavy hitter; batted .419 in 1887 to lead Detroit to N.L. pennant.

*Clark, Fred C. (born 1872), born Madison Co., Iowa; outfielder Louisville, N.L., 1894-99 (manager last three years); managed Pittsburgh, N.L., 1900-1915, winning pennant 4 times for Pirates.

*Collins, James J. (Jimmy) (1873-1943), born Buffalo, N.Y.; third baseman Boston, N.L., 1895-1900, Boston, A.L., 1901-7, and Philadelphia, A.L., 1907-8; managed Boston Red Sox to 1st world championship in 1903; was a steady star in field and at bat.

*Chosen by Hall of Fame Committee; all others elected by Baseball Writers' Association of America.

(Continued on the next page)

MEMBERS OF THE NATIONAL BASEBALL HALL OF FAME—Continued

(A L., American League; N L, National League)

***Delahanty Edward J.** (Big Ed) (1867-1903), born Cleveland, Ohio, outfielder, second and first baseman Philadelphia N L 1888-1903, and Washington N L 1902-3; one of game's greatest sluggers, batted 4 home runs and a slug in 1 game 1906, only player to lead both leagues in hitting National 1889 and American 1902

***Duffy Hugh** (1868-1954), born Riverport, R.I., outfielder, center fielder N L 1892-1900, first and defense player batted 438 in 1894, an all time high.

***Jennings Hugh Ambrose** (Eo-yah) (1870-1924), born Fitchburg, Mass., shortstop, center fielder Baltimore N L 1893-99, won 3 pennants as manager Detroit A L, 1907-20

***Kelly, Michael Joseph** (King) (1847-97), born Troy, N.Y., colorful catcher and outfielder with 4 N L teams 1878-93, batted 394 and stole 84 bases for Boston 1887

***Rourke James Henry** (Orator Jim) (1862-1919), born East Bridgewater, Conn., outfielder, first baseman, third baseman, catcher for 5 teams 1886-1904, played in major leagues at age of 32

***Robinson Wilbert** (Uncle Robbie) (1864-1934), born Hudson, Mass., catcher, center fielder Baltimore N L 1899-99, made 7 consecutive late in 1 game 1902, managed Brooklyn N L 1914-1921

Elected in 1916

***Barkett Jesse Call** (Crab) (born 1870), born Wheeling, W. Va., outfielder 1890-1901, with New York, Cleveland and St. Louis, all in National League 1900-5, with St. Louis and Boston in American League, one of 3 players to hit more than 400 for 3 seasons

***Chance, Frank Leroy** (Hunk) (1837-1924), born Fresno, Calif., first baseman Chicago N L 1898-1912 and New York A L 1913-14, managed 4 pennant winners for Chicago 1900-6, 1910, his 1906 team won 116 games, a record number

***Chesbro John Dwight** (Happy Jack) (1874-1931), born North Adams, Mass., pitcher Pittsburgh N L 1899-1902 and New York A L 1903, won 41 games in 1904, an all time modern record

***Evers John Joseph** (Crab) (1881-1947), born Troy, N.Y., second baseman Chicago N L 1902-13 and Boston N L 1914-17, member of famous Tinker to Evers to Chance double-play combination of pennant-winning Chicago Cubs 1908-8, 1910, started with Boston Braves, manager of team of 1914

***Griffith Clark C.** (Old Fox) (born 1869), born Nevada, Mo., pitcher with 5 major league teams 1894-1914, manager of 4 teams 1901-0, p. student of Washington A L after 1900

***McCarthy Thomas Francis** (1861-1922), born South Boston, Mass., outfielder with 5 teams 1884-96, stole 109 bases for St. Louis Browns 1896, made record number of 53 assists with Boston N L 1893

***McQuinn Joseph Jerome** (Iron Man) (1871-1939), born Rock Island, Ill., pitcher Baltimore N L 1899, Brooklyn N L 1900, Baltimore A L 1901-2 and New York N L 1903-8

5 times he pitched 2 games a 1 day pitched 434 innings 1903, a modern league record

***Plank Edward S.** (1875-1925), born Gettysburg, Pa., pitcher, center fielder Philadelphia A L 1901-14 won 5 games, including 0 or more a each of 3 seasons, one of the greatest left-handers of a time

***Tinker Joseph B.** (1850-1945), born Muscatota, Kan., shortstop, center fielder Chicago N L 1902-12, 1916, member of famous Tinker to Evers to Chance double-play combination of Chicago Cubs, pennant winners 1906-8, 1910

***Waddell George Edward** (Rube) (1878-1914), born Bedford, Pa., pitcher, center fielder Philadelphia A L 1900-7, was noted for at least one even a and colorful night y eccentric conduct

***Walsh Edward Augustus** (Big Ed) (born 1881), born Plains, Pa., pitcher Chicago A L 1904-16 and Boston N L 1917, noted as an iron man pitched 3 complete games a succession and total of 464 innings in 1908, a modern record, twice pitched and won 2 games a one day (1903, 1904)

Elected in 1947

Cochrane Gordon Stanley (Mort) (born 1893), born Bridgeport, Mass., catcher Philadelphia A L 1919-43 and Detroit A L 1934-37, 55 years, catcher and groomer, later managed Detroit pennant winning teams 1934-35

Franch Frank Francis (Fortham Flash) (born 1898), born New York, N.Y., second baseman New York N L 1919-28 and St. Louis N L 1927-37, went directly from college ranks to major league outstanding infielder base runner and battle played on 3 pennant-winning teams managed St. Louis, N L 1933-38

Grove Robert Moses (Lefty) (born 1900), born Lenoxton, Md., pitcher Philadelphia A L 1925-33 and Boston A L 1934-41, won 360 major league games, led league in strikeouts 1925-31, won 31 games and lost 4 in 1931

Hughall Carl Owen (King Carl) (born 1903), born Carthage, Mo., pitcher New York N L 1928-43, pitched 130 shutouts and 46 consecutive scoreless innings 1933, struck out 8 top hitters a success in 1934, All-Star game became director New York N L farm system 1943

Elected in 1918

Fenwick Herbert Jefferson (1894-1945), born Bennett Square, Pa., pitcher Philadelphia A L 1915-2 and New York A L 1923-33, won 241 games plus 5 (without a loss) in world series play

Trevnor Harold Joseph (Pie) (born 1823), born Framingham, Mass., third baseman Pittsburgh N L 1900-37, made 48 hits a 19, had lifetime batting average of .300, rated among top third basemen of all time

Elected in 1919

***Brown Mordcai Peter** (Mike) (1876-1945), born Newcastle, Ind., pitcher Chicago N L 1904-12, 1916 and Cincinnati N L 1913, first major league pitcher to pitch 4 consecutive shutouts 1904, had only 3 fingers on pitching (right) hand.

Gehring Charles Leonard (The Mole-eater Man) (born 1904), born Fowlerville, Mich., second baseman Detroit A L 1924-47, became vice-president of that team 1931, defensive star and had lifetime batting average of .321, played in 6 All-Star games

***Goehls Charles A.** (Kid) (1860-1933), born Madison, Wis., pitcher, center fielder Boston N L 1890-1901, won 30 or more games a each of seasons 1901-97, won 20 or more games a each of seasons 1890-99, won total of 260 games

None elected in 1950

Elected in 1951

Fox James Emory (Jimmie) (born 1907), born a Sudley, Md., 6'2" tall, second baseman Detroit A L 1936-42 and Chicago N L 1942-44, hit to total of 534 home runs, second only to Babe Ruth's 714 chosen for 7 All-Star games

Ott Melvin Thomas (born 1909), born Gretchen, La., outfielder and third baseman New York N L 1935-47, was a high school teacher to play a major league hit 511 home runs (3d highest total) and set several other all-time records chosen for 11 All-Star games

Elected in 1952

Holman Harry Edwin (1894-1951), born San Francisco, Calif., outfielder Detroit A L 1916-29 and Cincinnati N L 1930-32, had lifetime batting average of .342, led league in batting 1919, 1930, 1935 and 1937

Waner Paul Cleo (Big Po son) (born 1903), born Harrah, Okla., outfielder, center fielder Pittsburgh N L 1924-40, made 391 in a each of 8 seasons, made total of 3150 hits, with younger brother Lloyd or Little Po son, made famous brother combination on of Pirates

Elected in 1953

***Barrow Edward Grant** (Ed) (1868-1953), born Springfield, Ill., manager Detroit A L 1903-4, Boston A L 1919-0, bus. man, manager New York A L 1919-29, president 1939-45, discovered of Honus Wagner, changed Babe Ruth from pitcher to outfielder

***Bender Charles Albert** (Chief) (1883-1954), born Braunfeld, Pa., pitcher, first baseman, pitcher Philadelphia N L 1903-14, Bat more Federal League 1915 and Philadelphia N L 1916-17, first pitcher to win 6 world series games

***Connolly Thomas Henry** (Tommy) (born 1870), born Manx, Ariz., outfielder N L umpire 1898-1900, A L umpire 1901-31, umpire in chief A L 1891-3

Duan Jay Hanna (Dizzy) (born 1911), born a Lucas, Ark., pitcher St. Louis N L 1939-37, Chicago N L 1937-41, and St. Louis A L 1947-0, one half of colorful brother combination, Moe and Paul, which pitched St. Louis Cardinals to 3 pennants and 2 world championship

***Klem William J.** (Big) (1874-1951), born Rochester, N.Y., N L umpire 1903-40, 1st of N L umpires 1941-1951, worked in 13 world series for all time record for umpires

***Monmon Aloysius Harry** (Bucketfoot) (born 1903), born Milwaukee, Wis., real name Rymanski, outfielder, chiefly

*Chosen by Hall of Fame Committee, all others elected by Baseball Writers Association of America.

(Continued on the next page)

MEMBERS OF THE NATIONAL BASEBALL HALL OF FAME—Concluded

(A.L., American League; N.L., National League)

Philadelphia, A.L., 1924-32, and Chicago, A.L., 1933-35; led league in batting 1930-31 and in runs batted in 1930.

*Wallace, Rhoderick John (Bobby) (born 1874), born Millvale, Pa.; chiefly a shortstop (also third baseman, outfielder, pitcher, second baseman); played in major leagues for 25 consecutive seasons (2369 games); player for Cleveland, N.L., 1894-98, St. Louis, N.L., 1899-1901, St. Louis, A.L., 1902-16, St. Louis, N.L., 1917-18; manager Cincinnati, N.L., 1937.

*Wright, William Henry (Harry) (1835-95), born Sheffield, England; player-manager 1st professional team, Cincinnati Red Stockings, 1869-70, and Boston, N.L., 1871-78; nonplaying manager Boston, N.L., 1879-81, Providence, N.L., 1882-83, and Philadelphia, N.L., 1884-93; invented score card and introduced knickerbo into baseball uniforms; brother of George Wright, who was elected to National Baseball Hall of Fame in 1937.

Elected in 1954

Diekey, William Malcolm (Bill) (born 1907), born Bastrop, La.; catcher New York, A.L., 1928-43, player-manager May 24-Sept. 12, 1946, played in 1759 games in major leagues; worked as catcher in 100 or more games per year for 13 consecutive years; lifetime batting average of .313.

Maranville, Walter James Vincent (Rabbit) (1891-1954), born Springfield, Mass.; brilliant infielder, chiefly

a shortstop (also second baseman); played in major leagues for 23 years (2670 games); player for Boston, N.L., 1912-20, Pittsburgh, N.L., 1921-24, Chicago, N.L., 1925, Brooklyn, N.L., 1926, St. Louis, N.L., 1927-28, Boston, N.L., 1929-35.

Terry, William Harold (Bill) (born 1895), born Atlanta, Ga.; first baseman New York, N.L., 1923-36 (also manager 1932-36); nonplaying manager New York, N.L., 1937-41; batted .401 in 1930; lifetime batting average of .341.

Elected in 1955

*Baker, John Franklin (Home Run) (born 1886), born Trappe, Md.; third baseman Philadelphia, A.L., 1905-14, New York, A.L., 1916-19, 1921-22; led A.L. in home runs with 9, 10, and 12, in 1911-13; tied for home-run lead with 8 in 1914; lifetime batting average of .303.

DiMaggio, Joseph Paul (Joe) (born 1914), born Martinez, Calif.; outfielder New York, A.L., 1936-42, 1946-51; led A.L. in batting 1939 and 1940; set major-league record in 1941 by hitting safely in 56 consecutive games; hit 361 home runs; lifetime batting average of .325; played in 10 world series, including 51 games; chosen A.L.'s most valuable player 1939, 1941, and 1947.

Hartnett, Charles Leo (Gabby) (born 1900), born Woonsocket, R.I.; catcher Chicago, N.L., 1922-40 (also manager

1938-40), New York, N.L., 1941; hit 236 home runs; caught 100 or more games in each of 12 seasons; directed Chicago, N.L., to pennant in 1933.

Lyons, Theodore Amar (Ted) (born 1900), born Lake Charles, La.; pitcher Chicago, A.L., 1923-42, manager-pitcher 1946, manager 1947-48; went directly from Baylor University to major leagues; won 260 games, lost 230; won over 20 games in each of 3 seasons; lifetime earned run average of 3.67; pitched no-hit game against Boston, Aug. 21, 1926; known as a teacher of pitchers.

*Schalk, Raymond William (Ray, or Cracker) (born 1892), born Harvey, Ill.; catcher Chicago, A.L., 1912-26, manager-catcher Chicago, A.L., 1927-28, catcher-coach New York, N.L., 1929; led A.L. catchers in fielding 8 times between 1913 and 1922; caught 100 or more games in each of 12 seasons.

Vance, Arthur Charles (Dazzy) (born 1893), born Orient, Iowa; pitcher Pittsburgh, N.L., and New York, A.L., 1915, New York, A.L., 1918, Brooklyn, N.L., 1922-32, St. Louis, N.L., 1933, Cincinnati, N.L., and St. Louis, N.L., 1934, Brooklyn, N.L., 1935; won 197 games, lost 140; led N.L. in strike-outs 7 years in a row, 1922-28; had best earned-run average in N.L. 1924, 1928, and 1930; life time earned-run average of 3.54; won over 20 games in each of 3 major-league seasons; in 1924, best season, won 28, lost 6; pitched no-hit game against Philadelphia, Sept. 13, 1925.

*Chosen by Hall of Fame Committee; all others elected by Baseball Writers' Association of America.

cient Palestine, beyond the Jordan; famed for cattle of great size ("bulls of Bashan"): map B-138

Bashkir (bāsh-kēr'), Russ., an autonomous republic of R.S.F.S.R. in extreme east of European Russia; about 54,500 sq. mi.; pop. 3,145,000; cap. Ufa (pop. 300,000).

Bashkirs, a people in Russia of mixed Finnish and Tatar stock, Mohammedan in religion, living in Ural Mts. and neighboring plains.

Bashkirtsev (bāsh-kért'sév), Marie (1860-84), brilliant versatile Russian painter and author; famed after death through her 'Journal'.

Basic English, a system employing 850 normal English words, designed as a secondary or auxiliary language for international communication and useful also as a first step in learning English; invented by C. K. Ogden, British scholar, and completed in 1930; 600 of the words name things, 150 name qualities, 100 are used in expressing actions.

Basic salt, in chemistry A-10

Basic Seven Food Groups F-211, chart F-211

Basidiomycetes (bā-sīd-i-ō-mī-sē'tēz), class of fungi bearing basidia, special structures on which external spores are produced: F-316, M-457, Reference Outline B-264

Basie, William (Count) (born 1906), Negro pianist, composer, and bandleader, born Red Bank, N. J.; studied organ with "Fats" Waller ("One O'Clock Jump"; "Basie Boogie").

Basil (bāz'il) the Great, Saint (329-379), early father of Greek church, bishop of Caesarea in Cappadocia; opponent of Arian heresy; founder of Eastern monasticism; festival June 14: M-354-5 hospital at Cappadocia H-429b

Basilar membrane, of ear E-170-1

Basílica (from Greek word meaning "kingly"), term now used for large rectangular church, usually having aisles and an apse, or for a church so designated by pope because of historical or religious associations; first basilicas were Greek, then later Roman, public halls: A-311. See also in Index Architecture, table of terms

of Constantine A-310

Basiliata, region in s. Italy. See in Index Lucania

Basílik, fabled serpentlike monster L-284

Basílik, hooded, or helmeted, a lizard L-284, I-25

Baskerville, John (1706-75), English printer; printed beautiful editions of the Bible, Horace, Vergil, Milton, etc.: T-230

style of type, example B-235

Basket B-73-4, pictures B-73-4

how to make B-74, picture B-74

Indian B-73-4, pictures B-73, I-106b

Basket ash. See in Index Black ash

Basketball B-75-6, pictures B-75-75b

books on H-391

emotions of spectators, picture E-340

Basket boat B-74, B-217, pictures B-218, B-222b

Basket cloth, a textile in which two or more threads at a time are woven into the basket-weave pattern.

Basket fish, a starfish S-383

Basket flower. See in Index Peruvian daffodil

Basket Makers, an early American people B-76

baskets, pictures B-76

Canyon de Chelly N-30

Mesa Verde N-37

Basket weave, in textiles, color picture F-5

Basket-work huts, picture P-12

Basle, Switzerland. See in Index Basel

Basques (bāskz), people of region of Pyrenees Mts. in n.e. Spain and s.w. France S-314, F-239

folk dance, picture F-192b

legend of Roland F-178

under France S-322a

Basra (bās'rā), also Bassora, chief port of Iraq (Mesopotamia) on Shatt-el-Arab River, 60 mi. from Persian Gulf; pop. 93,859: I-225, maps A-285, A-406, A-531

Bas-relief. See in Index Low relief

Bas-Rhin (bās-rān), department of France in Alsace region A-181

Bass (bās), a fish B-77, F-114, color pictures F-117

male makes and guards nest, picture F-106

Bass (bās), in music, the lowest part in a composition; also the lowest male voice and the lowest staff range, diagram M-468b

Bassae (bās'ē), a place in ancient Arcadia, Greece, near Phigalia. See also in Index Phigalia

Bassanio (bās-sā'nē-ō), character in Shakespeare's 'Merchant of Venice' M-173

Bassarisk, also called racomistle, or ring-tailed cat, carnivorous mammal related to raccoon; lives in s.w. and w. U.S. and in Mexico and Central America; total length about 30 in. (half of this is tail); body slender; dark brown on back, yellowish gray on sides, buffy white below; tail ringed white and brown; fur softer and shorter than that of raccoon; scientific name *Bassariscus astutus*.

Bass clarinet W-189, picture M-471

Bass drum D-156, picture M-471

Bassedau, Johann Bernhard. See in Index Basedow

Bassein (bās-sān'), also Ngawun, Burma. trading town and port in s. on delta of Irrawaddy River; pop.

Key: cape, āt, fār, fāst, whāf, fāh; yēt, fērn, thēre; ice, bit; rōw, wōn, fōr, nōt, dā; cūre, būt, ryde, fūll, burn; out;

Bat ticks F-189

Battle, Mrs., in Charles Lamb's 'Essays of Elia', a whilst player who loved "a clear fire a clean hearth, and the rigor of the game."

Battle, trial by J-367

Battle above the Clouds, or battle of Lookout Mountain C-199, map C-199

Battle Creek, Mich., city 44 mi. s.w. of Lansing on Kalamazoo River; pop. 18,666. Battle Creek Sanitarium (established 1866): cereals printing presses, health food-wire. Battle Creek College; Camp Custer nearby. maps M-227, U-233

Battle cruiser N-85-6

'Battle Cry of Freedom', American Civil War song N-40

Battledore and shuttlecock, game played by two persons with small parchment or stringed racket called a battledore, and a shuttlecock of cork stuck with feathers; object to bat shuttlecock and keep it from falling to ground; played for centuries in Orient; modern development called badminton, especially popular in England and United States. See also in Index Badminton

Battlefield sites, national N-38c

'Battle Hymn of the Republic' N-40, picture N-43

'Battle of the Books', by Swift S-470

'Battle of the Nations' (Leipzig) N-10

Battles. A list of the world's greatest battles will be found on the following pages. See also in Index names of battles

Battles, Fifteen Decisive. See in Index Creasy, Sir Edward S

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Dreadnought begins new era N-92-3

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Battleship, a game G-8d

score keeping, chart G-8d

Battleship Day (February 15) F-56

Battleship linoleum L-255

Battle star, decoration, World War II D-39

Batu, Dutch Batoe (bát'ó), island group in Indonesia, w. of Sumatra; 463 sq. mi.; pop. 12,619; coconuts.

Batumi (bát'im'í), or Batum, Russia, port of Georgia on Black Sea; pop. 75,000; citrus fruits, tea, bamboo; railroad and oil pipelines to Baku; maps R-267, B-204, E-417

Batussi, a people of the Belgian Congo who rule the Bahutu by superior intelligence; narrower noses, thinner lips than most Negroes.

Baudis and Philemon. See in Index Philemon and Baucis

Baudelaire (bód-lér'), Charles Pierre (1821-67), French poet, born Paris; wrote chiefly on morbid, unwholesome subjects, as in 'Fleurs du mal' (Flowers of Evil); translated Edgar Allan Poe into French; also wrote 'Little Poems in Prose'.

Baudouin (bó-dv'án') (born 1930), king of the Belgians, became prince royal and regent of Belgium 1950 upon retirement of father, Leopold III, and king July 1951; B-117

Bauer, Andrew, German inventor P-414d

Bauer, Harold (1873-1951), pianist, born in England of German father and English mother; toured principal cities of Europe; played with leading orchestras in America.

Bauhans (bau'hous), institution founded in Weimar, Germany, 1919, by a group of artists and architects, with Walter Gropius as director; transferred to Dessau 1925; closed

by Nazi forces 1933; New Bauhaus (later Institute of Design) opened in Chicago 1937 by Moholy-Nagy. Its chief aim was to combine practical, manual training in workshops with theoretical instruction in design.

Bauhin (bó-ú'n'), Gaspard (1560-1624) Swiss botanist and anatomist, born Basel; professor of botany and anatomy at Basel; his classification of plants into genera and species preceded Linné.

Baum, L(ysman) Frank (1856-1919), author and journalist, born in Chittenango, N. Y.; best known for his 'Wonderful Wizard of Oz' and many other 'Oz' books for children; also wrote 'The Life and Adventures of Santa Claus'.

Baumé (bó-mé'), Antoine (1728-1804), French chemist, invented Baumé hydrometer with two scales, one for liquids heavier than air and one for liquids lighter than air; improved various manufacturing processes, including that for production of ammonium chloride.

Baumes Laws, amendments to New York State criminal code drafted 1926 under leadership of Caleb H. Baumes (1863-1937); drastic measures for prosecution and punishment of crime, including provision that persons convicted of felony for fourth time must serve life sentence.

Baux, Les, France. See in Index Les Baux

Bauxite (bók's'it or bók'it), chief aluminum ore A-182-3, table M-176

chemical composition M-265

producing regions A-360, B-182

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Bavaria (ba-vá'ri-a), German Bayern (bî'érn), state in s. Germany; pop. 9,126,010; 29,334 sq. mi.; B-82-4, G-89, map G-88, pictures B-82-3, G-90

agriculture B-82, pictures C-141a, G-91

birthplace of National Socialist German Workers' party H-385

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Neuschwanstein Castle, picture G-95

people: how the people live, pictures B-83, G-90, 91

rainfall G-91

Bavarian Alps T-232b, B-82, picture G-90

castle, picture G-95

Bay, Sir Arnold Edward Trevor (1883-1953), English composer of many piano and orchestra pieces; master of the king's music for George VI and master of the queen's music for Queen Elizabeth II; M-466

Baxter, Elsha (1827-99), governor of Arkansas A-371

Baxter, Richard (1615-91), English Puritan preacher and scholar, called the "chief of the English Protestant schoolmen" ('The Saint's Everlasting Rest').

Bay, in architecture. See in Index Architecture, table of terms

Bay, in geography, part of a sea or lake projecting into the land. For individual bays, see in Index name of bay, as Fundy, Bay of

Bay, or bay tree, also called sweet laurel L-137

Bayá (bá'yá) bird, a weaver bird of India W-82

Bayar, (Mahmut) Celal (bî-ür', má-mot' jâ-lâ'l') (born 1884), Turkish statesman; deputy in National Assembly 1923-45; helped form and became president of new Democratic party

1946; succeeded Ismet Inönü as president of Turkey 1950; visited U.S. officially 1954.

Bayard (bî'árd'), James Asheton (1767-1815), statesman, born Philadelphia, Pa.; U. S. senator, envoy to Russia, member of commission which negotiated Treaty of Ghent with Great Britain, picture M-23

Bayard (bá-yár'), Pierre du Terrail, Chevalier de (1475?-1524), French military commander in time of Charles VIII, Louis XII, and Francis I, model of chivalry and bravery; "the good knight without fear and without reproach."

Bayard (bî'árd'), Thomas Francis (1828-98), statesman, born Wilmington, Del.; his great-grandfather, Richard Bassett (1745-1815) grandfather, James Asheton Bayard (1767-1815), and father James Asheton Bayard II (1799-1880), were all distinguished American statesmen; U. S. secretary of state 1885-89; ambassador to Great Britain 1893-97; his son Thomas Francis Bayard (1868-1942), U. S. senator from Delaware 1922-29.

Bayazid I. See in Index Bajazet

Bayberry (bî'yricá carolinensis), a species of wax myrtle, found in e. and s. U.S.; sometimes called candleberry. Grows to 9 ft.; leaves oval; fruit gray-white, waxy, used to make bayberry wax. California bayberry (Myrica californica) native to Pacific coast, grows to 35 ft. in height. Has purple fruit.

Bay City, Mich., important port on Saginaw Bay; pop. 52,523; automobile parts, electrical transformers, cranes, hosiery, boats, lumber products; maps M-227, U-253

Bayern, Germany. See in Index Bavaria

Bayer process, for refining bauxite A-183

Bayeux (bá-yú'), France, historic town in Normandy; pop. 8744; famous for old cathedral, rebuilt by William the Conqueror, and for Bayeux tapestry: N-243, map E-425

Bayeux Tapestry, a seamless strip of linen, 230 ft. long and 20 in. wide, covered with 72 colored sketches in worsted embroidery; tells the story of the Norman Conquest: H-270, pictures E-360, 361

Bay laurel, bay tree, or sweet laurel L-137

Bayle (bél), Pierre (1647-1706), French philosopher and critic; was professor in Sedan and in Rotterdam; his writings, many of which subtly preach that religion and reason are opposed, involved him in many ecclesiastical quarrels and greatly influenced skeptical philosophy of 18th century ('Historical and Critical Dictionary').

Bayliss, Sir William Maddock (1860-1924), English physiologist, born Wolverhampton; authority on digestion; with Ernest Henry Starling, discovered secretin (they gave name "hormone" to secretin by endocrine glands); in World War I, Bayliss successfully treated wound shock ('Nature of Enzyme Action'; 'Principles of Physiology'; 'The Vaso-Motor System').

Baylor University, at Waco, Tex.; Baptist; chartered 1845; college of arts and sciences and schools of education, business, law, music; schools of dentistry and nursing at Dallas, of medicine at Houston; picture T-96

Bay lynx, or red lynx L-355

Baynton, Barbara Janet Ainsleigh (1862-1929), Australian short-

Key: cape, át, fär, fäst, whgt, fall; mé, yét, férn, thére; ice, bit; rôw, wón, fór, nó, d; édre, büt, ryde, full, búrn; out;

SOME OF THE WORLD'S MOST IMPORTANT BATTLES

Actium (31 B.C.) Sea battle between forces of Octavian and those of Mark Antony. Victory of Octavian made him first emperor of Rome and thereby founder of the Roman Empire.

Adrianople (378) Visigoths defeated the Roman legions under Valens and settled within the borders of the Eastern Roman Empire. Broke Roman superiority and inspired other Gothic nations to make incursions which led to the collapse of the Western Roman Empire.

Aedonopolis (405 B.C.) Sparta captured the Athenian fleet, led to downfall of Athenian Empire.

Agincourt (1415) Henry V of England decisively defeated the French, proving finally the superiority of the English longbowmen over the armored knights of France.

Arbela (331 B.C.) Alexander the Great finally defeated Darius III of Persia, and became master of Asia.

Armada Spanish (1588) flotilla of great, invulnerable English ships defeated great Spanish war fleet in English Channel, dealblow to Spain's mastery of the seas.

Artemisium (480 B.C.) Greeks in a naval battle defeated Persians under Xerxes.

Austerlitz (1805) Battle of Three Emperors. Napoleon defeated united forces of Russia and Austria under Alexander I and Francis II.

Bannockburn (1314) Robert Bruce of Scotland defeated the English in a decisive battle, making his throne and Scotland's independence secure.

Batman (1942) American troops under General MacArthur and Wainwright defeated Bataan Peninsula near Manila for three months until forced to surrender to numerically superior Japanese soldiers.

Blenheim (1704) English and Austrians under Marlborough and Eugene defeated French and Bavarians under Tallard in War of Spanish Succession, disappointed Louis XIV's dreams of universal conquest.

Bosworth Field (1485) Final battle of the War of the Roses. Henry, earl of Richmond, defeated Richard III. Henry became Henry VII and established Tudor line.

Bouvines (1214) French under Philip Augustus defeated allied English, German, Flemish, and Lotharingian forces. Strengthened growth of French national spirit.

Bovine (1690) William of Orange defeated the Stuart forces under James II. Ended any substantial prospect of restoration of the Stuart rule.

Britain (1940) German bombers assaulted Great Britain for 58 days in an effort to crush nation from the air. Heroic defense by Royal Air Force made Nazis give up costly day rash.

Bulge (1944) Germans under General von Rundstedt counterattacked and smashed wedge in Allied lines in France and Luxemburg. American troops forced bulge back and then drove into Germany.

Bunker Hill (1775) American colonists though forced to retreat, won a practical victory over the British. First real battle of the American Revolution.

Cannae (216 B.C.) Frightful battle in which Hannibal annihilated great Roman army, Rome's existence threatened.

Chersonesus (338 B.C.) Philip of Macedonia razed mastery of all Greece.

Chalons (451) Romans and Visigoths under Aetius and Theodoric checked Attila's advance in France saving Europe from the Huns.

Chios (1380) Naval battles between Venetians and Genoese. Capture of Genoese fleet gave Venice maritime supremacy.

Coral Sea (1942) In May planes from U.S. aircraft carriers attacked and destroyed many Japanese warships making apparent attack on Australia. The air-sea battle the first major Allied success against Japanese in World War II.

Crécy (1346) Edward III and English longbowmen won victory over a vastly superior French army of cavalry, greatly strengthened England's position in France.

Culloden Moor (1746) duke of Cumberland defeated Charles Edward, the Young Pretender. Last attempt of the Stuarts to regain the English throne.

El Alamein (1942) British 8th Army under General Montgomery counterattacked and pursued famed German Afrika Korps across North Africa, thus saving Egypt from German conquest.

Gettysburg (1863) Union troops under Meade sharply defeated Lee forcing his retreat from Northern end, one of decisive battles of Civil War.

Guadalcanal (1942-43) U.S. Marines wrested Guadalcanal island in Solomon from Japanese in bitterly fought six-month campaign. With this battle Americans went on offensive against Japanese in World War II.

Hastings (1066) William, duke of Normandy, defeated English king Harold falling in battle established Norman rule over England.

Iwo Jima (1945) U.S. Marines under Admiral MacArthur invaded Iwo Jima, 703 miles from Japanese homeland. In savage 26-day fight, Americans took the strategic island.

Jutland (1916) Most important naval conflict of World War I, in North Sea, after heavy losses on both sides, British fleet under Jellicoe and Beatty, forced retreat of German vessels.

Lake Erie (1813) Naval battle at Put in Bay Ohio. Americans under Commodore Perry defeated the British fleet. Secured the Northwest to U.S. in Treaty of Ghent.

Leipzig (1813) Frederick and Saxons under Gustavus Adolphus won brilliant victory over Catholic Imperialists and saved Protestant cause in Thirty Years' War, also called Breitenfeld.

Leipzig (1813) Battle of the Nations. After brilliant defeat inflicted upon Napoleon by allied forces, marked end of French rule in Germany, turning point in Napoleonic wars.

Lepanto (1571) Venetian and Spanish fleets under Don Juan of Austria decisively defeated Turkey in Gulf of Corinth, ending Turkish sea power.

Lützen (1632) Gustavus Adolphus, king of Sweden won a brilliant victory over the Imperialist forces under Wallenstein.

also but the Swedish leader was himself slain.

Manila Bay (1898) Dewey American admiral destroyed Spanish fleet in harbor and took forts and city without loss.

Manzikert (1071) Seljuk Turks defeated Romanus Diogenes emperor of the Eastern Roman Empire. Opened most of Asia Minor to Turkish conquest.

Marathon (490 B.C.) Miltiades with a small force of Athenians and Plateans routed large Persian army, saving Greece from Asiatic conquest.

Marne, First Battle of the (1914) French and British forces under Joffre and French checked German invasion in four day battle and drove them back to Aisne River where battle line remained nearly stationary for three years.

Marne, Second Battle of the (1918) Counteroffensive launched by U.S. with French and American troops, placed Germans permanently on defensive.

Marston Moor (1644) Cromwell's Ironsides defeated the Royalists and gained the north of England for Parliament.

Megiddo (478 B.C.) Thutmose III of Egypt defeated confederated king of Syria and Mesopotamia. Marked highest point of Egyptian conquest. Fought on battlefield of Armageddon.

Metz (207 B.C.) Romans under the consul Nero defeated Hannibal (who was slain) and his Carthaginians thus preventing the union of Hannibal and Hannibal, saving Italy.

Meuse-Arnonne (1918) In battle lasting 47 days Americans under Pershing fought through Argonne Forest broke through German line and crossed the Meuse River. Considered by Germans as decisive factor in their defeat in World War I.

Midway (1942) In two-day battle between American and Japanese naval air power in June American planes inflicted severe losses in warships and planes on enemy.

Milvian Bridge (A.D. 312) Constantine the Great defeated Maxentius and became sole ruler of the Western Roman Empire. See in Index De signis crucis.

Mohács (1526) Solyman the Magnificent of Turkey defeated Hungary and led his army to gates of Vienna.

Mukden (1905) Japanese defeated Russians under Kuropatkin.

Nile (1798) Naval battle in Aboukir Bay, Egypt, Nelson destroyed French fleet, cutting off Napoleon from France.

Normandy (1944) On June 6, Allied troops under American General First Army crossed English Channel and stormed beaches of Normandy. France from beachheads. Allies drove through France into Germany.

Orleans (1429) Joan of Arc raised English siege, turning point in Hundred Years War.

Pharsalus (48 B.C.) Decisive victory of Caesar over Pompey. Established Caesar as sole ruler of Rome.

Plessey (1757) British under Clive defeated forces of Suraj-ud Dowlah, nawab of Bengal, established British rule in India.

(Continued on the next page)

SOME OF THE WORLD'S MOST IMPORTANT BATTLES—*Concluded*

Plataea (479 B.C.): Greeks defeated the Persians and ended their attempt to invade Greece.

Plevna (1877): After five months' siege the Russians forced the surrender of this pivotal strategic point by the Turks, virtually concluding Russo-Turkish War.

Poitiers (1356): Victory of Black Prince over King John of France; many prisoners taken, including John, ended first period of Hundred Years' War.

Poltava (1709): Peter the Great of Russia completely defeated Charles XII of Sweden, annihilating his army; Russia succeeded Sweden as the leading power of the north at conclusion of the Great Northern War.

Quebec (1759): British under Wolfe stormed and took Quebec after gallant defense by French general, Montcalm, securing British domination of North America.

Sadowa (1866): Crushing defeat administered to Austria by Moltke, led to exclusion of Austria from German Confederation, also called Königgrätz.

Salamanca (1812): English under Wellington completely defeated the French. Ended Napoleon's Peninsular Campaign.

Salamis (480 B.C.): Athenian fleet built by Themistocles almost annihilated Persian fleet; forced withdrawal of Xerxes from Greece.

Salerno (1943): British troops invaded Italy at the toe of the boot. American troops landed at Salerno, south of Naples. The two Allied forces joined to liberate southern Italy and capture Naples.

Santiago (1898): American fleet commanded by Sampson destroyed Spain's Atlantic fleet under Cervera, forcing surrender of Spanish army in Cuba.

Saratoga (1777): Surrender of Burgoyne and his British army to American general, Gates; turning point in Revolutionary War.

Sea of Japan (1905): Japan destroyed Russian navy and became a world power, also called Tsushima.

Sedan (1870): Prussians under Moltke defeated MacMahon and forced surrender of Napoleon III and 100,000 men, caused fall of French Empire and proclamation of Third Republic.

Sempach (1386): Swiss defeated Austrians under Duke Leopold. Broke Austrian power over Swiss Confederacy. See in *Index* Winkelried, Arnold.

Sluys (1330): English and Flemish fleets under Edward III of England defeated the French and won command of the English Channel.

Solferino (1859): France and Sardinia-Piedmont under Napoleon III defeated the Austrians, the horror of this battle influenced Napoleon to make peace.

Somme (1916): English and French took offensive for five months, made small gain in territory at enormous cost but relieved Verdun and aided Russia in gaining eastern victory.

Stalingrad (1942-43): Germans drove deep into Russia and threatened to demoralize Russian army. But at Stalingrad on Volga River, Russians first stopped German drive, then counter-attacked with great ferocity.

Syracuse (413 B.C.): Syracusans with Spartan aid destroyed Athenian fleet dealing a deathblow to Athens' naval supremacy and contributing to its defeat in the Peloponnesian War.

Tannenberg (1914): Hindenburg stopped the Russian invasion of East Prussia.

Tarawa (1943): U. S. Marines under Admiral Nimitz stormed Tarawa Island in Gilberts. In desperate 76-hour fight,

(See also in *Index* Sieges, table)

Marines won island but suffered casualties of about 3,000 killed and wounded. One of bloodiest battles in Marine Corps history.

Teutoburger Wald (A.D. 9): Germans under Arminius (Hermann) annihilated Roman army commanded by Quintilius Varus; established Rhine and Danube as northern Roman frontier.

Thermopylae (480 B.C.): Heroic effort of Leonidas and a small body of Spartans to check Persian hordes of Xerxes in their march on Athens; Athens destroyed.

Tours (732): Charles Martel and the Franks forced the retreat of the Saracens, saving western Europe from Moslem invasion.

Trafalgar (1805): Nelson destroyed the combined French and Spanish fleets, firmly securing England's sea power, the chief menace to French conquests.

Tunisia (1943): American, British, and Free French forces pushed through Tunisia and forced German and Italian soldiers to surrender. Victory freed North Africa from Axis.

Valmy (1792): French commanded by Dumouriez defeated troops of "First Coalition" under Brunswick, saving revolutionary government from destruction at hands of invaders.

Verdun (1916): General Pétain retained fort in spite of supreme effort by Germans, thus keeping barred the road to Paris and increasing the confidence of the Allied forces.

Wagram (1809): Napoleon crushingly defeated the Austrians.

Waterloo (1815): English, Prussians, and allies under Wellington and Blücher effected final overthrow of Napoleon.

Yorktown (1781): Americans and French under Washington forced surrender of Lord Cornwallis with 7,000 men, practically ending Revolutionary War.

Ypres, First Battle of (1914): British prevented Germans from reaching Calais and occupying channel ports.

story writer, born Scone, New South Wales, Australia ('Bush Studies').

Bayonet B-484

Bayonne (*bā-yōn'*), France, historic town and fortress 4 mi. from Bay of Biscay; pop. 28,110; manufacturing and export trade; petroleum and its by-products; 13th-century cathedral; gave name to bayonet, first made here: maps F-259, E-425 banner of the Middle Ages F-136c, color picture F-132

Bayonne, N. J., port on Upper New York Bay; pop. 77,203: N-158, map, inset N-164

bridge B-308, picture B-311. See also in *Index* Bridge, table

Bayou (*bī'ou*), how formed L-87 Mississippi River M-308

Bayou State, popular name for Mississippi.

Bay porpoise P-375

'Bay Psalm Book' M-466, A-224

Bayreuth, or **Balreuth** (*bī-roit'*), Germany, city in Bavaria 126 mi. n. of Munich; pop. 58,800; home of Wagner, Wagnerian musical festivals. W-2, maps G-88, E-425

Bay rum, a toilet preparation made by mixing oil of bay with diluted alcohol and adding oil of allspice and oil of orange peel; original bay rum from West Indies

Bay State, or **Old Bay State**, popular name for Massachusetts.

Baytown, Tex., city 21 mi. e. of Houston on Houston Ship Canal; pop. 22,983; oil fields; petroleum products, synthetic rubber, carbon black; rice, cattle; Lee College: map, inset T-90

Bay tree. See in *Index* California laurel

Bay-winged bunting. See in *Index* Vesper sparrow

Bazaar', Oriental market place

Damascus D-12

Delhi D-60-1

Peking P-112

Bazaine (*bā-zēn'*), **Franois Achille** (1811-88), French marshal: commander in chief of the main French armies in Franco-Prussian War; in 1873, condemned by a military court for surrendering without sufficient cause, he was sentenced to life imprisonment. He escaped in 1874 and lived in Spain until his death siege of Metz M-184

Bazan, **Emilia Pardo**. See in *Index* Pardo Bazan

Bazin (*bā-zān'*), **René** (1853-1932), French novelist, born near Angers, France; novels depict wholesome family life and the peasants' love for the soil ('La Terre qui meurt'; 'Le Blé qui lève').

Bazooka, U. S. Army's rocket anti-tank gun R-172, pictures A-384, A-398

"B" battery, in radio R-37, 40

"B" complex, vitamin V-494-6, 498

Beach, **Amy Marcy Cheney** (Mrs. H. A. Beach) (1867-1944), pianist and composer, born Henniker, N. H.; wrote for orchestra ('Gaelic Symphony'); choral works ('The Minstrel and the King'; 'The Chambered Nautilus'); piano pieces; many songs.

Beach, Chester (born 1881), sculptor, born San Francisco, Calif.; works show originality in ideas, power in execution.

Beach, Rex (1877-1949), author, born Atwood, Mich.; attended Rollins College, also law schools; wrote novels of adventure ('The Spoilers'; 'The Barrier'; 'The Silver Horde'; 'Alaskan Adventures').

Beachcombers P-11

Beachy Head, chalk cliff (532 ft.) in Sussex, England, 3 mi. from Eastbourne; nearby Dutch and English fleet defeated (1690) by French: map B-325

Beacon (*bē-kōn'*), N. Y., city on Hudson River opposite Newburgh, in farm and fruit region; pop. 14,012; clothing, rubber goods, paints: map N-205

Key: cape, āt, far, fast, what, fāil; mē, yēt, fern, thère; ice, bit; rōw, won, fōr, nōt, dō; cāre, bīt, ryde, fūll, bārn; out;

- Beacon a guiding signal
 airplane A 95 L 310-11 picture
 A 535
 ancient T 36
 Beethouses L-236
 Palmolive beacon Chicago C 233
 picture C 233
 radio A 95 A 534 N 75 picture
 A 94 transponder R 27
 Beacon Hill Boston D 257-8
 Beaconfield curl of *See* in Index
 Diva 1
 Beale William Henry Harrison (1838-
 1915) pioneer and educator born
 Parks County Ind brigadier gen-
 eral Civil War president State
 Normal Madison S D 1899-1906
See also in Index Statuary Hall
 (South Dakota) table
 education in South Dakota S 306
 Beads
 ancient glass G 123
 embroidery in India picture A 421
 Bead tree a genus (*Nefia*) of trees
 native to Australia and *e* Asa
 includes Texas umbrella tree (25
 to 40 ft high) flowers purple in
 clusters fruit yellow
 Beagle a frigate D 110 color picture
 D-114 table D 118
 parts of picture D 110
 "Beagle" ship in which Darwin made
 voyages around world D 18-19
 Beak
 birds color pictures B 176
 bug distinguished by I 157
 Beal Clifford Kennells (born 1879)
 painter born New York City out-
 door and circus scenes vigorous
 realistic
 Beam *See* in Index Nautical terms
 table
 Beam in architecture a horizontal
 piece of wood stone or metal used
 to support overhead weight or re-
 sist a device thrust
 Egyptian picture A 306
 Greek architecture developed A 306
 picture A 308
 truss alternate form A 323
 Beam transmission in radio F 40 41
 43 M 94
 airplane guidance A 534 picture
 A 94 *See also* in Index Aviation
 table of terms
 Beau William (flourished 1760)
 pioneer born V re n a accom-
 panied Boone to Kentu ky in 1780
 sett le in Tennessee T 59
 Bear certain leguminous plants espe-
 cially of the genera *Pisoculus* and
Vicia and their seed name also
 ap plied to other bean shaped seed
 and to the plants bearing them
 such as the castor bean B 84 pic-
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 Bear Mexican jumping *See* in Index
 Jumping bear
 Bear beetle Mexican an insect pest
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 spray or by dust of calc um arsen-
 ate and copper lime acc dentally
 introduced into Alabama 1900
 Bear family *See* in Index Legumes
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 black B 88 pictures B 86 N 38b
 brown A 86a B 88 88, pictures
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 Himalayan B 88
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 length of life average pictograph
 A 249
 Malayan or sun B 85 88
 polar B 86 88 picture Z 359 alti-
 tude range picture Z 362
 spectacled B 85 88 altitude range
 picture Z 382
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 weight B 85 86 88
 yo ng B 86 N 56 56 polar bear B 88
 Bear in finance S 399 B 214
 Bear Gre t (Lynn Major) and Bear
 Little (Uren Minor) *See* in Index
 Great Bear Little Bear
 Bearberry a small trailing shrub
 (*Arctostaphylos uva-ursi*) of the
 heath fam ly w th thick evergreen
 leaves and clusters of small wh e
 flowers followed by bright red in-
 cidible berries
 Beard Charles Austin (1874-1949)
 historian born near Knightstown
 Ind profess r politics Columbia
 University 1915 17 emphasized the
 economic basis of p tical insti-
 tutions wrote An Economic Inter-
 pretation of the Constitution of the
 United States and (w th h s wife
 Mary Beard) The Rise of Ameri-
 can Civilization
 Beard Daniel Carter (1850-1941)
 artist author naturalist and out-
 door enthusiast born Cincinnati
 Ohio author of books on camp lore
 woodcraft and outdoor life organ-
 ized Sons of Daniel Boone fore-
 runner of Boy Scouts of America
 (American Boys Book of Bugs
 Butterflies and Beet es American
 Boys Book of Signs Signals and
 Symbols Shelters Shacks and
 Shanties)
 Beard Thomas first Amer can shoe
 maker em grated from London and
 settled in Salem Mass S 163
 Beard a so called awn
 barley pict re B 55
 wheat W 119 picture W 116
 Bearded seal S 90
 Beard vulture or lammergeier V 524
 Bearmore Glacier Antarctica dis-
 covered by Sir Ernest Shackleton
 1908 A 258 map A 259
 Beardsley Aubrey Vincent (1812 98)
 English artist works are fantastic
 and highly decorative best known
 for his unique handling of black
 and white in line and mass illus-
 trated Alexander Pope's "The Rape
 of the Lock" and Oscar Wilde's
 Salome
 Bearl tongue a genus *Pentstemon*
 (pent est mon) of perennial plants
 of fawort family with tubular
 flowers in a w de range of colors
 leaves usually oblong and opposite
 more than 100 species in North
 America
 how to plant G 13 14 table G 17
 Bear Flag Revolt ris ing against Mex-
 ican government (1846) by L S
 immigrants in California so called
 from flag with grizzly bear declar-
 ing California a republic C 47
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 Bearing metals any of the anti-
 friction alloys used for machine
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 Bearings A 173 *See also* in Index
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 of Sva bard N 304b map W 205
 Bear Mountain peak (2355 ft) in n w
 corner of Connecticut map C 444
 Bear Mounta n peak in New York
 (1314 ft) p c f re N 207
 Bear Mounta n Bridge N Y over
 Hudson R ver picture N 207 *See*
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 Bear n (b d ear) a historic French
 province map F 270
 Bear River about 350 mi long rises
 in U ta Mountains n Utah flows
 n w into a c Idaho then bends a
 to empty into Great Salt Lake n
 Utah maps U 410 416 I 21
 Bear State popular name for Arkan-
 sas
 Bear trap dam D 11
 Beas (b d as) ancient Hypha-
 river of Punjab 300 mi long
 flows s w into Sutlej R ver a trib-
 utary of the Indus I 128 map I 127
 Beast epic a popular medieval liter-
 ary form consisting of a series of
 stories attr but ng human qual it es
 to animals often satires on human
 behavior or sin is disputed but
 stories grew up around Reynard the
 Fox Bru n the Bear Chanticleer
 the Cock and others were popular
 in France w Germany and in
 Flanders in the 12th century
 Chaucer a tale C 203
 Reynard the Fox F 254 S 415-16
 Beast of burden T 170c *See also* in
 Index Pack transportation
 Bear electrical B 38
 Bear of sound S 240 diagram S 240
 Beattification *See* in Index Canoniza-
 tion
 Beating to windward in sailing pic-
 ture B 217
 Beatitude statements on blessed-
 ness made by Jesus in Sermon on
 the Mount (Matt v 3 12 Luke vi
 20-22)
 Beaton (be ton or ba ton) or Bethune
 David (1484?-1546) only Scottish
 cardinal ar g but unscrupulous
 statesman arrogant cruel and im-
 m oral L 63
 Beatrice (b e t r i s) in Shakespeare's
 Much Ado About Nothing clever
 vivacious scornful girl who falls
 in love with the scoffing Benedick
 her professed detestation
 Beatrice (b e t r e cha) in the Divina
 Commedia a the glorious lady of
 Dante's mystic adoration and his
 guide through Paradise identified
 with a cert n Beatrice Portinari
 (1260 90) whom he saw when they
 were b th children and but seldom
 thereafter D 14a 15 picture D 14a
 Beatrice (b e d tris) Neb city 38 mi
 s of Lincoln pop 11 813 in stock
 raising farming and dairying re-
 gion important trading center
 alloy steel tanks windmills pumps
 maps N 103 U 255-3
 Beattie (be t i e or be t i e) James (1735-
 1803) Scottish poet and philos-
 opher professor of moral philos-
 ophy Marischal College Aberdeen
 his Essay on the Nature and Im-
 mutability of Truth which opposed
 the skepticism of Hume made him
 famous as did h a descriptive poem
 in Spenserian stanza the Minstrel
 Beatty (be t e) David first Earl (1871-
 1936) British admiral served
 under Kitchener in Sudan 1898-99
 commanded battle cruiser squad-
 ron battle of Jutland commander
 in chief British Grand Fleet 1916-
 18 admiral of Fleet 1919 first sea

lord of admiralty 1919-27; created earl 1919

Dogger Bank battle W-224

Beaubien, Jean Baptiste (1787-1863), early Chicago settler, born Detroit, Mich.; bought house in Chicago in 1817; worked for American Fur Co.; in 1830's attempted to gain title to Fort Dearborn reservation

Beau Brummell. *See in Index* Brummell

Beauchamp, or Beauchamps (*bô-shan*), Pierre (1639?-1705?), French dancer; ballet master at Académie Royale, Paris. 1671-87, collaborated with Lully. D-14h

Beauchemin (*bô-shû-mân*'), Nérée (1850-1931), Canadian poet; wrote 'Les floraisons matinales'

Beaufort scale, for wind velocity, devised by Admiral Sir Francis Beaufort (1774-1857). W-155

Beaufort Sea, arm of the Arctic Ocean, n.w. of Canada, maps N-250, 245

Beaugency (*bô-zhan-sé*'), France, historic town on Loire River 15 mi. s.w. of Orléans; pop. 2927; victory of Joan of Arc over English (1429); French defeated in Franco-Prussian War, cloth leather, grain trade

Beauharnais (*bô-âr-né*'), Alexandre, vicomte de (1760-94), first husband of Josephine (later empress); J-363

children J-364

Beauharnais, Eugène (1781-1824), son of Empress Josephine J-364

Beauharnais, Hortense (1783-1837), daughter of Empress Josephine, and wife of Louis Bonaparte J-364

Beaumarchais (*bô-mar-shé*'), Pierre Augustin Caron de (1732-99), French political leader, dramatist, and satirist aided American Revolutionists ('Barber of Seville'; 'Marriage of Figaro').

Beaumont (*bô-mônt*) Francis (1581-1616), English dramatist whose association with John Fletcher formed a "perfect union in genius and friendship" which made their names inseparable ('Philoctet'; 'The Maid's Tragedy'; 'Knight of the Burning Pestle'). D-132

Beaumont, William (1785-1853), U.S. Army surgeon, born Lebanon, Conn., famed for exhaustive research in laws of digestion; noted experiments with Alexis St Martin whose stomach had been perforated by accidental gunshot wound ('Experiments and Observations on the Gastric Juice and the Physiology of Digestion').

Beaumont, Tex., port on Neches River 30 mi. from Gulf of Mexico; pop. 94,014; B-88-9, maps T-91, B-89, U-253

canal to Port Arthur. *See in Index* Canals table

Beauregard (*bô-rê-gârd*), Pierre Gustave Toutant (1818-93), Confederate general, born near New Orleans, La.; surrendered with Johnston to Sherman (1865)

Bull Run, first battle B-350, C-333

Fort Sumter attacked by F-242b

"Beauty Is truth" K-19

Beauvais (*bô-vé*'), France, capital of Oise, 42 mi. n.w. of Paris; pop. 20,910, tapestry, textile manufactures; many buildings destroyed in World War II; famous Gothic cathedral of St. Pierre, begun in 13th century, escaped destruction; map E-425

Beauvoir (*bô-vicûr*'), last residence of Jefferson Davis 1877-89; between Biloxi and Gulfport, Miss., facing Gulf of Mexico. Restored under auspices of Mississippi Sons of Confederate Veterans. Called "the Mount Vernon of the Confederacy."

Beaux (*bô*), Ceclia (1863-1912), painter, born Philadelphia, Pa.; free and easy technique, good composition and skillful illumination made her figures and portraits highly pleasing ('Mrs Theodore Roosevelt', 'Cynthia'; 'Ernesta and Her Little Brother').

Beaux, Les, France. *See in Index* Les Baux

Beaux-Arts, Ecole des. *See in Index* Ecole des Beaux-Arts

Beaver, Tony, hero of lumber camp tales F-197

Beaver, Indian tribe that lives in Alberta, Canada, map I-106f, table I-107

Beaver, animal B-89-92, pictures B-90-1, N-59, 62

altitude range, picture Z-362

castoreum, in perfume making P-149

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dam building and tree felling B-90-2, picture B-91

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fur B-92, F-323

hats B-92, F-323

protection B-92

skin used as money F-323

water table level and B-191

young, care of B-90, N-58

Beaverbrook, William Maxwell Aitken, first Baron (born 1879), British publicist, capitalist, and newspaper publisher; born New Brunswick, Canada amalgamated Canadian cement industry 1910; World War I represented Canadian government; raised to peerage 1918; in World War II British minister of aircraft production and later minister of state and British-American lend-lease co-ordinator; lord privy seal (for postwar civil aviation problems) 1943-45; chief owner of London Daily Express, Evening Standard, and Pall Mall Gazette; wrote 'Politicians and the War'.

Beaver cloth, thick woolen fabric with napped finish similar to broadcloth.

Beaver College, at Jenkintown, Pa.; Presbyterian, for women; chartered as seminary 1853, as college 1872; liberal arts and professional courses.

Beaver Dam, Wis., city 53 mi. n.w. of Milwaukee; pop. 11,867; shoes, ranges, and refrigerators; pea and corn canneries; map W-173

Beaver Dam Creek, battle of. *See in Index* Mechanicsville

Beaver Falls, Pa., city on Beaver River 28 mi. n.w. of Pittsburgh; pop. 17,375; abundant water power and coal for manufacturing; iron and steel, clay, pottery, cork products; Geneva College; map P-132

Beaver State, popular name for Oregon.

Beavertail cactus, color picture C-12

Bebel (*bâ-bêl*), (Ferdinand) August (1840-1913), German socialist; helped form German Social Democrat party.

Bebop, or bop, form of jazz music; first became popular 1947.

Beccaria (*bêk-kâ-î-â*), Cesare (1735-94), Italian publicist and political economist whose 'On Crimes and Punishments' had immense influence in removing barbarous punishment from penal codes.

Bêche-de-mer (*bêch-dû-mêr*'), trepang, or sea cucumber, a marine animal S-86

Becher (*bêk-êr*), Johann Joachim (1635-82), German chemist and physician, born Speyer; wrote 'Physica Subterranea', giving his ideas on minerals

phlogiston theory C-221

Bechet (*bê-shâ*), Sidney (born 1897), Negro jazz saxophonist and clarinetist, born New Orleans, La.; at 6 taught self to play clarinet; began playing professionally 1914; composed ballet 'Night Is a Sorceress'; toured Europe.

Bechuanaland (*bêch-u-â-na-lând*), name of regions in South Africa including Bechuanaland Protectorate (area 275,000 sq. mi.; pop. 296,310) and British Bechuanaland (annexed to Cape of Good Hope Province in 1895). The Protectorate is administered from Mafeking, Cape of Good Hope Province; chiefs rule their own people under a British royal commissioner; cattle raising is the chief industry; maps S-242, A-47

people, Bechuana A-43

relationships in continent, maps A-46-7, 41-2, 39, 51

Beck, Sir Adam (1857-1925), Canadian legislator, born Baden, Ontario; elected to legislature (1902-19 and 1923-25); became identified with work of developing and distributing power generated at Niagara Falls, chairman Ontario Hydro-Electric Power Commission.

Beck, David (Dave) (born 1894), labor leader, born Stockton, Calif.; president Western Conference of Teamsters 1937-; executive vice-president International Brotherhood of Teamsters 1947-52, president 1952-.

Beck, Lily Adams (Mrs. Lily Adams Beck) (died 1931), Canadian author; daughter of English admiral, John Moresby; lived for years in Orient; wrote historical novels as E. Barrington ('Glorious Apollo', 'The Divine Lady'), Oriental tales as L. Adams Beck ('The Key of Dreams'), adventure and South Sea stories as L. Moresby.

Becker, May Lamberton (born 1873), editor, critic, and lecturer, born New York City; at age of 18 wrote dramatic and musical criticism; editor 'Readers' Guide' in New York Herald Tribune 1933-55; compiled 'Golden Tales of the Old South', 'Golden Tales of New England', and other collections of regional short stories; author of 'Adventures in Reading', 'Books as Windows', 'Choosing Books for Children'.

Becket, Thomas (1118-70), also known as Thomas à Becket, archbishop of Canterbury shrine in Canterbury cathedral B-92, C-115

Becket, Thomas à, English actor, in Philadelphia in 1843; supposed author of 'Columbia, the Gem of the Ocean'.

Beckford, William (1750-1844), English writer, author of 'History of Caliph Vathek' (oriental "gothic" romance, written in French) and of books of travel; wealthy and eccentric, he built magnificent home at Fonthill Abbey, where he lived alone.

Beckley, W. Va., city in Appalachian Highlands, 46 mi. s.e. of Charleston, in "smokeless coal" region; pop. 19,397; seat of Raleigh County; map W-106

Beckwith, James Carroll (1852-1917), painter, born Hannibal, Mo.; portraits ('The Authoress', 'Mrs. Beckwith', 'Mark Twain').

Becque (*bêk*), Henri François (1837-99), French dramatist; pioneer in naturalism in French drama; presents episodes from ordinary life, with little attention to plot ('The Woman of Paris').

Becquerel (bē r ē) Alexandre (1852-1908) French physicist noted for researches in electricity and light sensitive phosphoroscope

Becquerel Antoine Cesar (1788-1878) French physician first of distinguished family one of founders of electroch. surgery

Becquerel Antoine Henri (1852-1908) son of Alex. H. B. Becquerel shared Nobel prize with Pierre and Marie Curie (1903) discoverer of radioactivity R 53

Bee American colonial A 194 picture A 210

camp ladd r g C 58

Ch. new C 263

European ancient F 319c pictures L 281

Japanese picture J 303

period types pictures L 177 180 184 pioneer Northwest picture F 263

Roman F 519c

State standardized U 366

Beelzebub a small flat bloodsucking insect (Comez lecturarius) of reddish brown color of the order Hemiptera, family Cimicidae is parasitic on man picture I 79 color picture I 154b

Beddoes (bē d ē) Thomas (1760-1808) English physician and scientist established institution for treatment of disease by inhalation of gases employed Sir Humphry Davy as his assistant

Beddoes Thomas Lovell (1803-49) English dramatist and poet lyrics show influence of Shelley (Death's Jest Book) Bede (bē d ē) or Bæda

(673-735) English monk known as the Venerable Bede and father of English History gentle pious humble scholar greatest in Saxon England (Eccelesiastical History of the English Nation chief source of information for period covered) commemorated as saint May 27 E 375

quated E 375 translated Gospel of St John B 133-4

Bedford Francis (1799-1883) English bookbinder B 241

Bedford Gunning Jr. (1741-1812) Revolutionary War statesman born Philadelphia Pa. represented Delaware in Continental Congress and at Constitutional Convention and signed United States Constitution U S Judge Delaware district 1789 1802

Bedford John duke of (1389-1433) son of Henry IV of England and brother of Henry V protector of England and regent of France in reign of Henry VI In Shakespeare's Henry IV he is the sober sensible Prince John of Lancaster foil for wild Prince Hal

Bedford or Bedfordshire a midland county of England 473 sq mi pop 311 844 cap Bedford map E 347

Bedford England capital of Bedfordshire on Ouse River 43 mi n.w. of London pop 53 063 famous grammar school founded 1552 home of John Bunyan map B 325

Bedford Ind. 45 mi s.w. of Indianapolis pop 12 662 center of great limestone quarries map I 79

Bedford Mass. small village n.w. of Boston near Concord pop of town ship 5234 pop inset M 132 flag of minutemen F 130c color picture F 128

Bedfordshire England See in Index Bedford

Bēder (bē d ē) Joseph (1864-

1934) French writer and professor and ex-lit. critic and literature Collège de France director *Revue de France* (Les Légendes Épiques) presenting theory that epic poems are products of age when first written down not oral heritage of earlier times Lal de l'œuvre Roman de Tristan et Isolot

Bēd Ivēre Sir a knight of the Found Table 1 236

Bellum popular name of St Mary of Bethlehem Hospital in London England founded 1247 as a priory later he came insane asylum second a ch. sp. in Europe word came into general use for a lunatic asylum or mad asylum

Bellington terrace color picture D 111 table L 115b

Bellor's Island or Liberty Island in New York harbor maps W 222 B 329

Statue of Liberty L 179 picture L 179

Belduine wandering Arabs in deserts of Arab and North Africa A 290 286 7 N 242-242b pictures A 284 A 403 N 242b

Bedstraw or cleavers slender herbs comprising the genus *Galium* of the madder family with square stems whorled leaves and small flowers in flat topped clusters roots of several species yield a red dye some species used in ancient times for bedding flowers of yellow bedstraw (*Galium verum*) perennial employed in cheese making in Europe

Bee **Barnard Elliott** (1824-61) Confederate general born Charleston S.C. served in Mexican War under Taylor and Scott fatally wounded at Bull Run making heroic stand with Gen. Thomas Jackson nicknamed Jackson Stonewall J 289

Bee an insect B 93 100 W 52 pictures B 93 6 98 100 color pictures B 97 I 154d W 51 See also in Index Beeswax Honey community life B 93-100 pictures B 93-6 98-100

drone B 96 picture B 94 egg B 94 picture B 269

flight language of diagram B 100

honeycomb B 93 94 picture B 98

inquilines lazy bees B 100

kinds bumblebees B 93 98 99 W 52 color pictures B 97 I 154d F 420b, W 51

carpenter B 97-100

honey B 93-6 pictures B 98 races B 96

leaf cutter B 100

miner B 100

social B 93 9

soldier B 99 100 93

stingless B 99

larvae B 94 pictures B 95

parasite picture F 79

pollen carriers B 93 4 100 pictures B 94 N 52 bumblebees B 95 93 C 369

pollination importance of B 93

queen B 94-6 pictures B 93 94 95

reproduction on B 94 98 picture B 95

sting B 94 picture I 155

stinging bees at home N 67

swarming B 96 picture B 98

wasps attack W 53

wasps d. ferretated from W 52,

color picture W 51

worker B 93-4 pictures B 94 95

See neighborly gathering A 210

F 265

Bēder (bē d ē) Charles William (born 1877) American naturalist, explorer and writer B 100-1

deep sea exploration B 100 101

E 455 O 3,3 picture B 100

cells breeding place confirmed E 267

Beer B 91

Beech tree B 101 pictures B 101, T 181-2 F 155 table W 186c

Antarctic T 184

blue or water beech See in Index Hornbeam

furture L 180

leaf B 101 pictures B 101 T 183

Beecham Sir Thomas (born 1879) British conductor and operatic manager founder of London Philharmonic Orchestra has conducted in New York City Chicago and other cities in the United States

Beecher Henry War I (1813 87) American preacher B 101-2 picture B 101

brother of Harriet B. Stowe S 424

Hall of Fame table B 249

woman in Prago picture T W 184

Beecher Lyman (1775-1863) theologian called father of more brains than any other man in America

born New Haven Conn. pastor in Litchfield Conn. and Boston great Lane Theological seminary Conn. B 101

father of Harriet B. Stowe S 424

Beech family or Fagaceae (in 5d se 4) 2 family of plants native to the Northern Hemisphere including the oaks beech chestnuts giant

chestnut B 101 picture B 101

Beech Francis See in Index Saunders Hilary Alden St George

Beef flesh of cattle used for food cattle breeds C 145-6 pictures C 143 dual purpose breeds C 146-7 picture L 145

cits pictures M 156b

grades C 145

meatly beef W 302

packing house process M 154 pictures M 155-6b

tapeworm W 302

Beefsteak a bird See in Index Tick bird

Beefsteaks See in Index Yeoman of the Guard

Bee fly fuzzy flies of the family Bombyliidae larvae live as parasites in the nests of other insects

beehive cox oven C 280

Beehive state popular name for Utah

Beelzebub (bē zē bē) or Baalzebub in Old Testament, heathen god (II Kings I 3 6) in New Testament prince of devils in Milton's Paradise Lost Satan's chief lieutenant picture M 259

Bee martin or Kingbird L 45 color picture B 183

Beer Thomas (1859-1940) writer born Council Bluffs Iowa educated at Yale University and Columbia Law School (The Mauve Decade study of American life at end of 19th century "Sandoval and The Road to Heaven" novel) Stephen Crane biography

Beer (bē r) Wilhelm (1797-1850) German astronomer and banker brother of composer Giacomo Meyerbeer established observatory in Tiergarten Berlin with J. H. von Mädler prepared detailed map of moon 1834-38

Beer A 146

Lavarian production M 450

Beerbohm (bē r b ū m) Sir Max (born 1873) English author and caricaturist half brother of Herbert Beerbohm Tree in his fiction he says parodies and caricatures plays polished sophistication detached observation and irony (Seven Men, Observations, and Rossetti and His Circle) caric

- captures, 'Zuleika Dobson', novel; 'A Christmas Garland' parodies).
- Beer Hall Putsch, in Germany H-385, M-450
- Beers, Clifford Whittingham (1876-1943), author and humanitarian, born New Haven, Conn.; lost his reason and after recovery wrote about onset and cure of his disease ('A Mind That Found Itself'); founded Connecticut Society for Mental Hygiene, 1908, first of its kind in world
- Beersheba (*bē-ēr-shē'bā*), village in Palestine, 45 mi. s.w. of Jerusalem; pop. about 6500; referred to frequently in Bible as southern limit of Palestine ("Dan to Beersheba") because it stands on borderland between cultivated land to the north and the desert (Negeb) to the south maps I-256, P-45. See also in *Index* Dan
- Berry, Wallace (1886-1949), motion-picture actor, born Kansas City, Mo.; began motion-picture career in 1913 as female impersonator; earned fame for portraying gruff yet kindhearted characters; won Academy award for role in 'The Champ' (1931); his many films include 'Min and Bill' and 'Tugboat Annie', both with Marie Dressler.
- Beeswax B-96, W-76
- commercial uses B-96; candles L-89; electrotyping E-321
- manufactured by bees B-94
- Beet B-102
- when and how to plant, table G-19
- Beet, sugar, beet with high sugar content B-102, pictures S-445
- breeding increases sugar P-306, B-102
- by-products S-446
- harvester, pictures A-63, C-411
- industry S-444-5, 446, pictures A-143, S-445, 446; beginnings S-445
- producing regions
- Europe S-446
- United States S-446; Colorado C-411, 412; South Dakota S-295; Wyoming, picture W-325
- Beethoven (*bā'tō-vēn*), Ludwig van (1770-1827), German composer and musician B-102-3, picture B-102
- birthplace and museum B-228
- first great composer for piano P-248
- place in history of music M-463
- Beetle B-103-8, pictures B-103-7, color pictures I-154d. See also in *Index* Weevil
- antennae E-108
- armor (chitin) B-103, 104
- control S-356-7, P-392, J-364
- distinguished from other insects B-108
- evolution and embryo changes E-451
- eye B-108, picture E-461
- foot and claw, picture F-225
- killed by wasp W-50
- kinds
- blister B-107, P-392, picture B-105
- bombardier B-104, picture B-107
- Calosoma, picture B-104
- carpet B-107
- click B-106
- "death watch" B-107, picture B-106
- diving B-107, picture B-105
- elephant B-104, picture B-105
- engraver, picture I-162
- firefly and glowworm F-92, pictures F-92
- ground B-106, picture B-105, color picture I-154d
- Hercules B-108, picture B-105
- Japanese I-163, pictures I-163, N-53
- June bug J-364
- ladybug, or ladybird L-84, pictures I-164, N-53; hibernation H-352
- oil, picture B-105
- pine F-238
- potato bug P-392
- rove, or devil's coachhorse B-108, picture B-106
- scarab sacred B-106
- snout W-85, color picture I-154d
- stag B-108
- tiger B-104, pictures B-105, 107
- tumblebug B-106
- water B-107-8
- whirligig B-108
- largest and smallest B-104
- name, origin B-104
- sound, how made, picture B-106
- wings B-103, 104
- Beetle-hunting wasp, a solitary wasp of the genus *Cerceris* W-50
- Beetleware, trade name for a kind of plastic ware made from urea resin; subjected to intense heat, is molded into tableware and utensils; light in weight, durable, noninflammable colors usually red, green, orange, yellow.
- Beetree, local name applied to the linden tree L-254
- Beets (*bāts*), Nikolaus (1814-1903), Dutch writer, famous for his 'Camera Obscura', stories and sketches of peasant life showing humor and keen observation; wrote several volumes of poems ('Cornflowers', 'New Poems').
- Beet sugar. See in *Index* Beet, sugar
- Begas (*bā'gās*), Reinhold (1831-1911), German sculptor of the naturalistic school. Important works include monuments, portrait busts, genre, and mythological subjects.
- Begbie, Sir Matthew Baillie (1819-94), Canadian frontier judge, born Edinburgh, Scotland; 1858 made judge of crown colony of British Columbia and maintained order there during the "gold rush"; chief justice of British Columbia 1870-94.
- Bergar's Opera, a ballad opera by John Gay in which the characters were highwaymen, pickpockets, and thieves; a parody on the Italian operas of the day; first produced in London 1728; many times revived: O-398, picture O-395
- Berging Brothers, Franciscans F-276. See also in *Index* Franciscans
- Bégin (*bā'-zhān'*), Louis Nazaire (1840-1925), Canadian cardinal, primate of Roman Catholic church in Canada, born Lévis, Quebec; became archbishop of Quebec 1898; cardinal 1914.
- Beron (*bā'-jōn'*), Michel (1638-1710), French naval officer and patron of science
- begonia named for B-108
- Begonia family, or Begoniaceae (*bē'-gō-ni-ā'-sē-ē*), a family of plants and shrubs, native to the tropics, including the hillebrandia and the begonia B-108
- new plant from begonia leaf, picture P-300
- Begum (*bā'gūm* or *bē'gūm*), title given to sultanas, princesses, or other Mohammedan women of high rank, as Begum of Bhopal. See also in *Index* Bhopal
- Begum of Oudh H-280
- Behaim (*bā'hīm*), Martin (1459?-1507?) German navigator, geographer, merchant; in 1492 constructed globe, preserved at Nuremberg, based on round earth theory but showing geographic misconceptions of day.
- Behavior, animal P-427, 427a. See also in *Index* Animals, subheads
- communication, community and social life, courtship, emotions, instinct and intelligence, learning, reflexes; Birds subhead migration; Hibernation: Migration of animals
- Behavior, human P-427, pictures P-426-7, 428, Reference-Outline
- P-429. See also in *Index* Child development; Child training; Psychology
- adolescence A-22-22b, pictures A-22-22b
- behaviorism, in psychology P-427, C-246-7
- conditioned reflex R-90
- development C-239-48, pictures C-239-43, 245-8
- emotion E-340-340b, pictures E-340-340b
- etiquette E-404-11, pictures E-407-9
- group, study of (sociology) S-220-2
- habit H-240
- individual differences I-113-14, chart I-114
- Involuntary reaction W-134
- learning L-143-6, pictures L-143-6
- maturity M-142-1, pictures M-142-1
- natural, in children C-243
- nerves N-110-13
- personality P-159a-60, pictures P-159b-c, Reference-Outline P-159d-60
- psychology P-426-9, pictures P-426-7, 428
- public places, manners E-405-6
- reflex actions R-89-90
- voluntary actions W-134
- will W-134-5
- Behaviorism, in psychology P-427
- influence on education E-246-7
- Behemoth, animal, in Bible H-359
- Behistun (*bā'hīs-ton*) rock, in w. Iran, map I-224, picture P-158
- Behn (*bēn*), Aphra (1640-89), the first professional English authoress; was a government spy for a time, then wrote plays and novels very popular in her time, but now little read because of their vulgarity. As a child she lived in Surinam where she met Oroonoko, the original of her novel by that name ('The Fort'd Marriage'; 'The Rover'; 'Sir Patient Fancy').
- Behrens (*bā'rēnz*), Peter (1868-1940), architect, born Hamburg, Germany; exponent of functionalism; noted chiefly for stark, simple, and finely proportioned factories and apartment buildings.
- Behring (*bā'ring*), Emil Adolf von (1854-1917), German physician; discovered diphtheria antitoxin; bovine vaccine to immunize cattle against tuberculosis; received Nobel prize in medicine (1901)
- serum therapy S-103-4
- Behring, Vitus. See in *Index* Berling
- Behrman (*bēr'mān*), Samuel Nathaniel (born 1893), playwright, born Worcester, Mass.; light comedies ('Second Man'; 'Meteor'; 'Brief Moment'; 'Biography'; 'End of Summer'; 'No Time for Comedy'; 'The Pirate'); motion-picture scripts ('Queen Christina'; 'Tale of Two Cities').
- Beiderbecke, Bix (Leon Bismarck Beiderbecke) (1905-31), trumpet player, pianist, and composer, born Davenport, Iowa; exponent of "hot" jazz ('In a Mist').
- Beim, Jerrold (born 1910), author, born Newark, N. J.; lived for two years in Taxco, Mexico; there, with wife, Lorraine Levey, he wrote children's book 'The Burro That Had a Name'; also wrote 'Andy and the School Bus'; 'The Smallest Boy in the Class'; 'Country Train'; 'Tim and the Tool Chest'; 'Shoes-shine Boy'.
- Beim, Lorraine Levey (Mrs. Jerrold Beim) (1909-51), author, born Syracuse, N. Y.; a riding accident turned her interests to Georgia Warm Springs Foundation, for infantile paralysis, which resulted

- presidency 1860; supported Confederacy during Civil War: L-250
- Bell, Margaret Elizabeth** (born 1898), author, born Alaska; this land is the background for her books for boys and girls; there, during World War II, she worked with U. S. Army ('Watch For a Tall White Sail'; 'The Totem Casts a Shadow'; 'Ride Out the Storm').
- Bell, Robert** (1841-1917), Canadian geologist, born Toronto, Ontario; professor of chemistry and natural sciences, Queen's University, Kingston; director Geological Survey; explored Baffin Land and Hudson Bay country, and surveyed large part of Canada.
- Bell, Thomas**, Scottish inventor I-131-2
- Bell, Calif.**, city 5 mi. s.e. of Los Angeles; pop. 15,430; chiefly residential: map, inset C-35
- Bell B-118-21**, pictures B-118-21
- Big Ben** L-304
- chimes** B-119; Bruges bell tower, picture B-333
- church bells** B-118
- Czar-Kolokol** at Moscow B-121, picture B-121
- Liberty Bell** D-35, picture D-34
- Lutine Bell** in Lloyd's of London, picture I-169
- making and tuning** B-119
- ringing** B-119, pictures B-118, 120
- ship's time** T-137
- Bell, electric** E-292
- Bella Coola** (bē'lā kō'lā), Salishan Indian tribe of British Columbia, Canada.
- Belladonna**, or deadly nightshade N-237, P-341
- Bellairé**, Ohio, city on Ohio River 4 mi. below Wheeling, W. Va.; pop. 12,573; in coal, iron, and clay region; glass and enamel wares; important river commerce: map O-356
- Bellaire, Tex.**, residential suburb of Houston; pop. 10,173; map, inset T-90
- Bellamy, Edward** (1850-98), author and social reformer, born Chicopee Falls, Mass. ('Looking Backward' depicts an imagined socialistic society): A-230, N-311
- Bellamy, Francis** (1855-1931), editor and preacher, born Mount Morris, N.Y.; wrote pledge to the flag for first national Columbus Day celebration in 1892: F-124
- Bellanca** (bē'lān'kă), Giuseppe Mario (born 1866), American airplane builder, born Selacca, Italy; manufactured first plane with propeller on front instead of rear; invented aircraft safety devices; best-known plane, Columbia, used by Clarence D. Chamberlin in New York-Berlin flight 1927.
- Bellarmino, Robert, Saint** (1542-1621), Roman Catholic cardinal and theologian, born Italy; became a Jesuit in 1560; taught theology at University of Louvain, Belgium, 1570-76; made cardinal of Naples in 1598; canonized 1930; declared doctor of the church by Pope Pius XI 1931; preached and wrote against the heresies of the day and about the relation of church and state; feast day May 13.
- Bellay** (bē-lē'), Jean du (1492-1560), French cardinal, friend of Rabelais R-19
- Bellbird**, name given to various tropical birds of the genus *Chasmorhynchus*, whose notes sound like a bell; pure white with a curious caruncle (fleshy appendage) hanging from forehead, some species having up to three caruncles.
- Bell crank**, a bent lever, picture M-160b
- Belleau** (bē-lō') Wood, France, battle in World War I, near Château-Thierry B-122, W-238
- Belleek ware**, porcelain P-399
- imitated in U.S.** P-399
- Bellefontaine**, Ohio, city 50 mi. n.w. of Columbus in farming district; pop. 10,232; railroad shops; funeral cars and buses, matches, metal furniture: map O-356
- Belle Fourche** (bēl'fōrsh) Dam, in South Dakota, on Owl Creek S-295
- Belle Isle** (il), Detroit, Mich., picture D-75
- Belle Isle, Strait of**, channel between Labrador and Newfoundland, Canada, n. entrance to Gulf of St. Lawrence from Atlantic; 10 to 15 mi. wide; named from granite island at Atlantic end. C-109, maps C-73, 69
- Bellerophon** (bē-lēr'ō-fōn), in Greek myth, rider of Pegasus P-110, picture M-475
- Belleview, Ill.**, city 14 mi. s.e. of St. Louis, Mo., in coal-mining region; pop. 32,721; stoves, shoes, machinery; Scott Field, U. S. Air Force base: maps U-253, inset I-37
- Bellevue, N. J.**, residential suburb of Newark, on Passaic River; pop. 32,019; map N-164
- Belleville, Ontario, Canada**, port on Bay of Quinté and Moira River about 100 mi. e. of Toronto; pop. 19,519; cement works, saw and planing mills, foundries; ships grain, lumber, and dairy products; Albert University: map C-72
- Bellevue, Pa.**, residential borough 7 mi. n.w. of Pittsburgh; pop. 11,604; map, inset P-132
- Bellflower**, common name of a genus (*Campanula*), chiefly of perennial plants; includes bluebell, Canterbury bell, harebell: B-211
- how to plant**, table G-16
- Bellflower family**, or Campanulaceae (kām-pān-ū-lā'sē-ē), a family of plants, shrubs, and trees, including balloon flower, Venus' looking-glass, bluebell, shepherd's-scabious, and giant bellflower.
- Bellfagert**, in international law I-190
- Bellingham, Wash.**, shipping center 75 mi. n. of Seattle on Bellingham Bay; gateway to Mt. Baker National Forest; pop. 34,112; salmon-fishing center of the Pacific; lumbering and dairying interests; canned salmon and fruit, lumber products, coal, cement, beet sugar; Western Washington College of Education: maps W-44, U-252
- Bellingrath Gardens**, about 20 mi. s. of Mobile, Ala. M-328
- Bellingshausen** (bēl'lingz-hou-zēn), Fabian Gottlieb von (1778-1852), Russian Antarctic explorer and naval officer P-350, table P-349
- Bellingshausen Sea**, in South Pacific Ocean, off Antarctica between Alexander I Island and Thurston Peninsula; named for Fabian G. von Bellingshausen who led Russian Expedition of 1819-21: maps A-259, W-204
- Bellini** (bēl'lēnē), Giovanni (1430?-1516) and Gentile (1429-1507), Venetian painters, brothers; Giovanni was first great Venetian colorist and most important figure of early Venetian school: T-138
- Bellini, Jacopo** (1400?-1470 or 1471), painter, born in Venice; father of Gentile and Giovanni Bellini; important in the development of Venetian art; only a few paintings, mainly religious, and two remarkable books of drawings are extant.
- Bellini, Vincenzo** (1801-35), Italian composer, born Catania, Sicily; so talented as a child that Sicilian nobleman paid for education at Naples conservatory; wrote operas with delightful melodies; arias exploit human voice, sung with success by Grisi, Patti, and Lilli Lehmann ('La Sonnambula'; 'Norma'; 'I Puritani').
- Bellis**, a genus of low herbs of the composite family; includes the true daisy, *Bellis perennis*, a popular garden flower, often called English daisy: D-5
- how to plant**, table G-16
- Bell lyra** (lī'rā), lyre-shaped glockenspiel mounted on a rod, so that it is portable; used in bands: picture M-471. See also in Index Glockenspiel
- Bellman, Carl Michael** (1740-93), Swedish lyric poet; poems and songs, gay and patriotic in spirit; ballads popular among Swedes.
- Bell metal** B-119
- Bello** (bē'lō), Andrés (1781-1865), educator and poet of Chile L-114, 126, picture L-125
- Belloe** (bē'lō'), Hilarie (1870-1953), English author B-122, picture B-122
- Bello Horizonte**, Brazil. See in Index Belo Horizonte
- Bellona** (bē-lō'nā), in Roman mythology, goddess of war, described as wife or sister of Mars; a temple in her honor was built outside the city gates of Rome.
- Bellows**, George Wesley (1882-1925), painter, born Columbus, Ohio; work characterized by boldness and breadth in execution; often satirical in spirit ('Up the Hudson'; 'Forty-two Kids'; 'Skating'): P-35
- 'Lady Jean'** P-35, color picture P-34d
- Bellows**, in organ O-424, picture O-423
- 'Bell'** pepper P-143
- Bell Rock**, or Inchcape Rock, dangerous reef in North Sea opposite Firth of Tay, Scotland; Souther's ballad 'The Inchcape Rock' repeats legend of pirate who removed from rock the bell placed on it by Abbot of Aberbrothok, later being wrecked there; lighthouse designed by Robert Stevenson erected in 1810.
- Bells**. See in Index Nautical terms, table
- Bell-Smith, Frederick Marlett** (1846-1923), Canadian painter, born London, England; most celebrated for landscapes, although figure and portrait work holds high rank ('Lights of a City Street'; 'Queen Victoria's Tribute to Canada').
- Bell Telephone System** T-44, 45, table I-140
- Bell tower**, a belfry or campanile B-118
- Belgium**: Bruges, picture B-333; Brussels B-334
- Giotto's Tower** I-279, G-111, pictures G-111, F-147
- Giralda**, Tower S-109, picture S-109
- Leaning Tower of Pisa** P-272, picture P-273
- Parliament building**, London L-504, picture G-173
- St. Mark's** V-445, picture V-447
- St. Michel**, Bordeaux B-252
- Siena**, picture I-285
- Singing Tower**, in Mountain Lake Sanctuary F-162-3, picture F-162
- Springfield**, Mass. S-358
- Bellwort**, fleshy-rooted herbs comprising the genus *Uvularia* of the lily family; drooping yellowish bell-shaped flowers; stems appear to run through the leaves (perfoliate).
- Belly River**, in Alberta, Canada, unites with Bow River to form South Saskatchewan.
- Bel-Merodach**, name for Baal B-1
- Belmont**, August (1816-90), American financier, born Alzey, Germany; came to New York as representative of Rothschilds, bankers; acted

Key: cape, ât, fâr, fâst, whqt, fall; mē, yēt, tērn, thêre; ice. bît; rōw, wōn, fōr, nôt, dō; cûre, bût, ryde, full, bûrn; out;

as consul general for Austria U S minister to the Netherlands American Democratic National Committee father of Jerry Belmont (1850-1947) U S minister to Spain (1888-89) and August Belmont (1853-1914) financier and democratic leader

Belmont Mass town 7 mi n w of Boston market gardens furnish vegetables for Boston pop of town ship 27 351 n w map M 132

Belo Horizonte formerly Bello Horizonte (bêlô hôrê ôntê) city in Brazil capital of state of Minas Gerais mining agriculture diamond cutting pop 346 707 37a n w Rio de Janeiro maps D 288 S 252

Belt Wis city on Rock River near Illinois border in rich agricultural region pop 29 590 scales wood working and paper mill machinery engines W 178 maps W 173 U 153

Belted College at Beloit, Wis. chartered 1846 opened 1847 arts and sciences

Bel Paese (bê pâs) an Italian cheese of rubbery texture flavored between Cheddar and Limburger

Belphoebe (bêl fê bê) huntress in Spenser's Faerie Queene she symbolizes womanly side of Queen Elizabeth I Gloriana another character symbolizes her as ruler

Belshazzar (bêl shâz'ar) in the Book of Daniel, last king of Babylon son and successor of Nebuchadnezzar warned of his doom by hand writing on the wall, interpreted by Daniel B 9

Belted fisher K 45

Belt generator a machine for building up high electric charges the charge is collected by brushes in contact with a rapidly moving belt and accumulated in a large metal globe invented by R J Van de Graaff in 1933 and used for atom smashing

Belted rubber

Belted rubber manufacture R 240

Belt of calm See in Index Doldrums

Beluga See in Index White whale

Befakha or Byelukha (bêl fê kô) Siberia highest mountain in Altai Range 16 157 ft map R 259

Belvedere (bêl vê dêr) Italian belfry (bêl vê dârd) a gallery in the Vatican Rome which contains fine art treasures including the Apollo Belvedere and the Laocöon

Bely Andrey See in Index Belye

Bemberg rayon C 162 table C 162

Bemmelmann Ludwig (born 1828) American writer and illustrator born Merano Tyrol to U S 1914 became citizen 1918 known as author-illustrator of witty humorist books (for children Hansel and Madeline a Rescue awarded Caldecott medal 1934 for adults Hotel Splendide I Love You I Love You I Love You The Blue Danube Father Dear Father)

Bend (bê mîj) Minn., city and summer resort on Bemidji Lake 140 mi n w of Duluth pop 10 001 farming region dairy and wood products brick, furs airport State Teachers College Itasca State Park nearby map M 286

statues of Paul Bunyan and Babe the Blue Ox, picture M 290

Benda (bê mîs) Samuel Flagg (born 1891) educator and historian born Worcester Mass two Pulitzer prizes 1927 (history) for Plunket's Treaty a Study of America's Advantages from Europe a Distress and 1950 (biography) for John

Quincy Adams and the Foundations of America Foreign Policy editor and part author The American Secretaries of State and Their Diplomacy

Bemis Heights battles of See in Index Saratoga battles of

Ben Ami Jacob (born 1890) American actor born Ninsk Russia came to U S soon after World War I to play in Yiddish Art Theater

Benares (bê nâr's) or Banaras city in India on Ganges River pop 355 77 B 123 G 10 maps I 54 A 407 int e L 133

Benavente y Martinez (bê nâ ven tê d e nî ô t ê n t ê) Jacinto (1866-1934) Spanish dramatist influential in freeing modern Spanish stage from artificiality and melodrama awarded Nobel prize in literature 1927 (The Pass on Flower The Bonds of Interest Smile of Mona Lisa) S 327 picture S 327

Benbecula Island of Hebrides H 327 map E 324

Ben Bolt the name of a song by The Dixie Dancers (1819-1902) began with Don't you remember sweet Alice Ben Bolt? first published about 1840

Benchley Robert Charles (1889-1945) humorist and critic born Worcester Mass managing editor Vanity Fair 1919 20 drama critic Life 19 0-9 and New Yorker 1929-40 wrote and acted for stage motion pictures and radio (Of All Things Love Conquers All My Ten Years a Quarry Quarry Benchley beside Himself Chips Off the Old Benchley Benchley—Or Else)

Bench mining See in Index Open pit mining

Bench show dog show D 120

Bench warrant See in Index Law table of legal terms

Bend One city in central part of state on Deschutes River pop 11 400 lumbering and agricultural center maps O 417 U 252

Bend See in Index Nautical terms table

Bend in horology H 341

Benda (bê nâ dâ) Julien (born 1857) French philosopher born Paris foe of Bergson philosophy (The Treason of the Intellectual)

Benda Wladyslaw Theodor (1873-1948) American artist, born Poznan Poland best known for illustrations and for fantastic masks used in stage productions

Bend day process in photoengraving P 210-6

Bender Ereğli Turkey See in Index Ereğli

Benediga (bê nî dî gâ) Australia city in Victoria 90 mi n w of Melbourne pop 30 778 formerly large gold field map A 487

Bendix starter automobile A 527 picture A 528

Bene the or calisson Marasco C 17, M 351

Benedek in Shakespeare's Much Ado About Nothing a wit and avowed bachelor who caught by the same trick that snared Beatrice falls in love with her becoming "Benedick the married man"

Benedict Saint (430?-547?) (Bene dict of Nursia) Italian monk, dictator of the Benedictine Order founder of the Benedictine Order festival March 21 M 355, B 356-7

Benedictine popes For list, see in Index Pope table

Benedict I (died 579) pope B 123

Benedict V (died 883) pope B 124

Benedict XIII (1649-1730) pope B 124

Benedict VIII (Pedro de Luna) (1224?-1233?) antipope B 124

Bene Net XIV (1875-175A) pope B 124 stopped destruction of Colosseum p e I 184

Benedict XV (1854-1922) pope B 123

Benedict Ruth Fulton (1887-1948) author and professor of anthropology at Columbia University born New York City specialist in study of behavior patterns made extensive studies of American Indian (Patterns of Culture Races of Mankind Zont Mythology Rare Science and Politics)

Benedictine a monastic order sometimes called Black Monks there was an order of nuns by the same name M 355

Benedictine B 237 Westminster Abbey W 93

Benedictine Insurance I 168 will W 124

Benedictine iron ore enrichment I 238

Benedictine a form of landholding in feudal times F 61

Benedict of clergy privilege claimed by medieval clergy of being tried in bishop's instead of king's court under secular jurisdiction finally abolished in England 1877

Benedictine B 92

Benefits

Industry I 144

labor unions L 73

veterans V 468-469a table V 468a

Bencke (bê nê kê) Friedrich Eduard (1795-1854) German psychologist and professor of philosophy opposed Hegel an speculation taught empirical genetic psychology

Bencke (bê nê kê) Gordon Lee (Tex) (born 1914) astrophysicist and band leader born Fort Worth Texas chosen to lead Glenn Miller's orchestra after latter's death

Benelli (bê nêlî dâ) Rem (1877-1949) Italian playwright, particularly successful with historical dramas in blank verse (The Jew The Love Thief The Whim The Love of Three Kings used for opera)

Benelux (Belgium Netherlands Luxembourg) E 458

Beneš (bê nê sh) Fânuš (1884-1948) president of Czechoslovakia 1935-38 1945-46 foreign minister 1918-35 with Masaryk organized independence movement helped found Little Entente came to United States and was appointed to faculty of University of Chicago 1939 president of Czechoslovak government in exile after July 1941 returned to Czechoslovakia 1945 resigned as president 1945 rather than approve new constitution (Spirit of the Czechoslovak Revolution) C 536

Benét (bê nê dâ) Laura (born 1894) poet and author of children's books born Fort Hamilton N Y sister of Stephen and William Benét (Basket for a Fair poetry biographies of Jenny Lind and Thackeray Famous American Poets)

Benét Stephen Vincent (1898-1943) poet and novelist, born Bethlehem Pa brother of William Rose Benét wrote Five Men and Pompey Western Star America a history S 417 John Brown's Body (Pulitzer prize 1929) A 230d L 98b

Kipling characterized by K 43 quoted F 205-7

Benét William Rose (1886-1950) poet novelist and critic born Fort Hamilton N Y married Elinor Wylie 1923 and Marjorie Flack 1941 verse rich in imagination vigorous rhythms (The Falconer of God Man Possessed The First Person Singular novel) Won

- Pulitzer prize 1942 with 'The Dust Which Is God,' novel in verse.
- Benevento** (*bā-nā-vēn'tō*) (ancient Beneventum), Italy, town 32 ml. n.e. of Naples; pop. 26,692; arch of Trajan; map E-425
- Beneventum**, battle of (275 B.C.), Romans defeat Pyrrhus P-448
- Bengal** (*bēn-gāl'*), former British province in n.e. India; divided between India and Pakistan 1947: B-124, I-68b, map I-68a
- Clive C-352**
- Hastings H-280**
- Javan rhinoceros R-134**
- Bengal**, Bay of, portion of Indian Ocean between Indian peninsula and Burma I-87, B-359, maps I-54, A-407, 411
- Bengal**, East, province of Pakistan. *See in Index East Bengal*
- Bengal**, West, state of India. *See in Index West Bengal*
- Bengali** (*bēn-gāl'i*), modern dialect of India, akin to Uriya, Assamese, Bihari, and Hindustani, word of English origin, derived from *Bengal*, in which province it is spoken; makes free use of Sanskrit words; literature known in Western world through works of Tagore: L-98
- Ben'galine**, a silk fabric similar to poplin but heavier.
- Bengal tiger T-133**, picture T-133
- Bengasi**, or **Benzhal** (*bēn-gā'zī*), Libya, joint capital with Tripoli, coast city, founded by Greeks of Cyrenaica as Hesperides; renamed Berynice by Ptolemy III; pop. 49,727: L-219, map A-45
- rainfall L-218**
- Bengough** (*bēn-gōf'*), John Wilson (1851-1923), Canadian cartoonist and poet, born Toronto; founded humorous weekly *Grip*; later cartoonist with *Montreal Star* and *Toronto Globe*.
- Benguella** (*bēng-gē'l'a*), Current, or **Benguella Current**, cold current in South Atlantic Ocean; moves northward along west coast of Africa, map O-335
- South African deserts affected by S-241**
- Ben-Gurion**, David (born 1886), Israeli leader; emigrated from Poland to Palestine 1906; helped found Jewish labor organization 1920; became first prime minister of Israel 1948, resigned 1953; author of 'Rebirth and Destiny of Israel': I-256, 257
- 'Ben Hur**, a Tale of the Christ', a vivid story by Lew Wallace (1860). The hero, a noble young Jew, innocently condemned to the galleys by the Romans, has many adventures, and eventually becomes a Christian: A-230, picture S-195
- Beni-Hassan** (*bā'nē-hā'sūn*), village, Upper Egypt; rock tombs and paintings (about 3000 B.C.).
- Benitoite** (*bē-nē'tō-it*), a transparent blue or colorless mineral (BaTiSi₃O₈) used as a gem; found only in California.
- Benjamin**, youngest son of Jacob and Rachel, and ancestor of the tribe of Benjamin (Gen. xxxv, 18).
- Benjamin**, Judah Philip (1811-84), American lawyer, born Saint Croix, West Indies; Confederate political leader, attorney general and secretary of war 1861, secretary of state 1862-65.
- Benjamin bush**. *See in Index Spice bush*
- Ben Lo'mond**, mountain (3192 ft.) in Stirlingshire, Scotland, on shore of Loch Lomond S-63
- Ben Macduhl** (*māk-dū'ē*), second highest mountain (4296 ft.) in Great Britain; in Grampian Range, Scotland.
- Bennet**, Elizabeth, sensible, charming heroine of Jane Austen's 'Pride and Prejudice'; Elizabeth is 'Prejudice' and Philip Darcy, whom she finally marries, is 'Pride.'
- Bennet**, Henry, earl of Arlington. *See in Index Arlington*, Henry Bennet, earl of
- Bennett**, Arnold (Enoch) (1867-1931), English novelist and playwright, born Staffordshire; trained for law; editor of *Woman*, weekly paper, 1896-1900; portrayed middle-class English life (novels: 'The Old Wives' Tale'; 'Clayhanger'; 'The Card'; 'Riceyman Steps'; plays: 'Milestones'; 'The Great Adventure', dramatization of his novel, 'Buried Alive'; short stories: 'Tales of the Five Towns'): E-382a. *See also in Index Five Towns*
- Bennett**, Charles H. (1829-67), English illustrator, wood engraver; illustrated children's books, also 'Pilgrim's Progress', and made drawings for 'Pilgrim's Progress' B-354, 355
- Bennett**, Lloyd (1890-1928), aviator, born Warrensburg, N. Y.; in aviation corps, U. S. Navy; awarded Congressional Medal of Honor; developed pneumonia in flight to aid German-Irish transatlantic fliers, and was stranded near Quebec, Canada, where he died
- North Pole flight (1926)**, table A-104
- Bennett**, James Gordon (1795-1872), American journalist, born Scotland; originated detailed reporting of public events, practice of interviewing, use of telegraph in reporting, and system of distribution by carriers, making the *New York Herald*, started 1835, one of the most valuable newspaper properties
- balloon race instituted B-30**
- newspaper innovations N-188-9**
- Bennett**, James Gordon, Jr. (1841-1918), editor and proprietor *New York Herald*, born New York City
- sends Stanley to Africa S-368**
- Bennett**, John (born 1865), writer, born Chillicothe, Ohio; contributor of articles on Negro dialect and folklore to magazines; wrote stories of Elizabethan period and other tales for children ('Master Skylark'; 'The Story of Barnaby Lee').
- Bennett**, Richard (born 1899), Irish-American artist and author of books for children ('Skookum and Sandy', outdoor life in Pacific Northwest; 'Shawneen and the Gander' and 'Hannah Marie', Irish in scene and humor).
- Bennett**, Richard Bedford, Viscount (1870-1947), Canadian statesman, born near Hopewell, New Brunswick; several years in Canadian House of Commons; served as minister of justice and attorney general and as minister of finance; as leader of Conservative party was prime minister of Canada 1930-35.
- Bennett**, Sir William Sterndale (1816-75), English pianist and composer; greatly influenced by Mendelssohn; produced work of grace and charm ('Woman of Samaria', cantata; 'Paradise and the Peri', overture).
- Bennett**, Lake, Yukon, Canada Y-348
- Bennett College**, at Greensboro, N.C.; Methodist; for women; founded 1873; coeducational until 1926; arts and sciences.
- Ben Ne'vis**, peak in western Scotland; highest point in British Isles (4406 ft.): S-63, maps B-321, 324
- Bennington**, VT., village 30 ml. n.e. of Troy, N. Y.; pop. 8002; Bennington College: V-460, map V-457
- pottery P-399**
- Bennington**, battle of V-462
- celebrated F-57**
- Bennington College**, at Bennington, Vt.; for women; opened 1932; liberal arts, dance, drama, music, science, visual art.
- Bennington Flag**, carried at battle of Bennington (1777) F-130d, color picture F-128
- Benny**, Jack, real name Benjamin Kubelsky (born 1894), motion-picture, radio, and television actor, born Waukegan, Ill.; (motion pictures: 'Hollywood Revue of 1929', 'Buck Benny Rides Again', 'Charley's Aunt').
- Benozzo Gozzoli**. *See in Index Gozzoli*, Benozzo
- Benson**, Arthur Christopher (1862-1925), English essayist and literary critic; son of Edward W. Benson; meditative, refined, scholarly ('The Upton Letters'; 'From a College Window'; 'Walter Pater') quoted on conversation C-459
- Benson**, Edward Frederic (1867-1940), English author; son of Edward W. Benson; in youth with British Archeological School in Athens; first attained fame with society novel 'Dodo' (1893); also wrote 'Vintage'; 'The Capsina'; 'David Blaize'; 'Mezzanine'; 'Pharisees and Publicans'; 'Lucia' books; 'As We Were'; 'Queen Victoria'.
- Benson**, Edward White (1829-96), English churchman, archbishop of Canterbury; father of Arthur C. Edward F., and Robert Hugh Benson.
- Benson**, Ezra Taft (born 1899), farm marketing specialist, born Franklin County, Idaho; engaged in farming 1923-29; economist and marketing specialist University of Idaho extension service 1930-38; executive secretary National Council of Farmer Co-operatives 1939-44; member, quorum of 12 apostles of Mormon church 1943-52, took leave of absence to serve as U.S. secretary of agriculture 1953-; picture E-287d
- Benson**, Frank Weston (1862-1951), American painter and etcher, born Salem, Mass.; portraits of women and children in bright outdoor settings; etchings of wild ducks.
- Benson**, Robert Hugh (1871-1914), Roman Catholic priest; son of Edward W. Benson; wrote on religious subjects and several novels ('The Light Invisible'; 'Christ in the Church'; 'Come Rack! Come Rope!'; 'An Average Man').
- Benson**, Stella (1892-1933), English novelist, poet ('Living Alone'; 'The Poor Man'; 'Good-bye, Stranger'; 'The Faraway Bride'; 'Hope against Hope', short stories).
- Benson**, William Shepherd (1855-1932), admiral, United States Navy; graduated U. S. Naval Academy; chief of naval operations 1915-19.
- Bentzen**, Frederick W. (1834-93), soldier, born Petersburg, Va.; became colonel in Civil War
- aids Custer C-531**
- Bentgrass**, common name for a genus (*Agrostis*) of grasses, usually perennial. Although seeds are produced, these plants generally multiply by means of stolons (creeping stems that take root on, or just below surface of the ground). Used for forage and lawns; important species: redtop (*A. alba*), colonial bent (*A. tenuis*), creeping

Key: *cāpe*, *āt*, *fār*, *fāst*, *whāṭ*, *fāll*; *mē*, *yēt*, *fēr*, *thēre*; *ice*, *bīt*; *rōw*, *wōn*, *fōr*, *nōt*, *dq*; *cūre*, *būt*, *ryde*, *fyll*, *būrn*; *out*;

bent (A. polastris) velvet bent (4 romina)

Bentham George (1800-1884) Eng
ish botanist and lawyer b'n
Stoke England nephew of Jeremy
Bentham extended classification of
plants (Genera Plantarum w/ h
Sir Joseph Hooker Handbook of
British Flora)

Be than Jeremy (1748-1832) Eng
h philosopher and jurist shocked
by legal abuses he surveyed exist-
ing institutions to see whether they
served the greatest good of the
greatest number thus founding
utilitarian school P 212

Be than form of marine life O 332
Benthocore (from bentho meaning
sea bottom and skope meaning
to view)

depth reached diagram A 455

Bentley Fdm n'l Clerlew (born
18 5) English journalist and writer
of detective nove s (Trent's Last
Case Trent Intervenes) sh rt
stories and verse originated cleri-
cous type of humorous verse as
"Sir Christopher Wren"

Said I am going to dine with
some men

If anybody calls

Say I am designing St Pauls

Bentley Wilson Wryns (1865-1911)
meteorologist born in Jericho V
photographed snow crystals S 210

Benton Thomas Hart (178-1854)
US senator B 124

Freemont, son in law F 284 C 47

B 224

quoted on Zachary Taylor T 28

Statuary Hall See in Index Stat

uary Hall (Missouri) table

Benton Thomas Hart (born 1839)

painter born Nesho Mo named

for his great uncle Thomas H Ben-

ton studied art in Paris but found

his subject matter in common Amer-

ican life skilled draftsman vir-

orous and often cartoonlike in his

emphasis famous for murals in

Whitney Museum and New School

for Social Research in New York

City and in Missouri State Capitol

autobiography An Artist in

America

Benton Harbor Mich one of the

world's largest peach markets

across Lake Michigan from Ch-

cago pop 18 763 ships quanties

of other fruit various manufac-

tures map M 227

Bentonite claylike mineral of vol-

canic origin capable of absorbing

enormous quantities of water when

soaked in water serves purpose of

soap used as filter for oil and as

filter blinder or plastic in manu-

facture of great variety of articles

first found in commerce at quantities

around Fort Benton Wyo C 341

Benu (ba nud) chief a tributary of

the Niger w Africa 870 mi long

large part navigable map A 48

Beuz Karl (1844-1929) German

engineer and inventor born Karls-

ruhe Germany A 504

Benzene a compound of carbon and

hydrogen (C₆H₆) often called ben-

zol B 124 H 459 O 424a See also

in Index Benzene

formula diagram O 424a

products from C 370-1 C 119

Benzene ring H 459 O 424a diagrams

H 459 O-424a

Benzine a mixture of paraffin hydro-

carbons distilled from petroleum

B 124 See also in Index Benzene

Benzolate of soda a salt of benzoic

acid and sodium

antiseptic and food preservative

A 266

Benzole acid an organic acid

u=French u German u pen so til then

u=French u German u pen so til then

(C₆H₆) formed from benzene and

crystalline at ord nary tempera-

tures used in dynamite and

needed to obtain synthetically

from toluol or the gum benzo n

Benzol (ben zol) a resinous sub-

stance obtained from the stems of

various species of Symplocos espe-

cially St rox batio a tree of

south Asia used in medicine as

an emetic and in perfume

Benzol See in Index Benzene

Benzel (ben zel) Isaac or Itzhak

(born 1844) 2d president of Isra-

el author of work on haecology and

Near East scholar born Poltava

Ukraine settled in Palest n 1907

chief spokesman for Palest ne

Jews during British mandate one

of key figures in establishment of

Israel president 1951-55 leader

of labor n'ty (Mapal)

Beograd ugovat See in Index

Begrade

Beothik Indian tribe that formerly

lived in Newfoundland Canada

map 1106; table I 197

Brow it (brow it) hero of Anglo

Saxon pie B 125 4 413 M 478

Beowulf epic poem E 375 B 125

L 265

quoted E 375

Bequest in law See in Index Law

table of legal terms

Bequerel (ber ker) Pierre Jean

(18 1807) French physicist ter-

rest of the people and political

satirist

Beas India See in Index Central

Provinces

Bebar (ber ber) ancient white race

of n Africa includes Kabyle

Swans Tulu and Tuareg gave

name to Barbary States M 389

A 39 color picture A 35

Algeria A 165 184

Libya L-219

Morocco M 393 394

Sahara S 16

Barbera capital principal city and

port of British Somaliland n e

Africa pop 20 000 maps A 285

A 48

Barberis lacene See in Index Barbary

family

Barberis name of the barberry genus

of shrubs H 329

Bercause See in Index Music table

of musical terms and forms

Berchtesgaden (ber tsen ga den)

Germany village in se of Bavaria

in Salzburg Austria pop 5752

summer and winter resort noted for

scen e beauty On the helix n near

Berchtesgaden were built Adolf H

itler's chalet Berghof and his re-

reat Eagle's Nest In 1945 the

Berghof was shattered by bombs

from British planes In 1952 a Ger-

man demolition firm salvaged some

of the ruins of the Berghof and de-

stroyed the rest with explosives

Bergeret (ber ker) Konrad

(born 1825) Amer can novelist and

short story writer born Bral a

Romania became US citizen 1929

earlier years devoted to music

and teaching later years to

travel and writing spent much time

among the gypsies (Githis and

Other Romances of Gypsy Blood

Against the Sky Nights Abroad)

Against the Sky Nights Abroad)

Against the Sky Nights Abroad)

Against the Sky Nights Abroad)

Against the Sky Nights Abroad)

Against the Sky Nights Abroad)

pop 68 396 famous fairs scene of

many conflicts between Poles and

Russians map R 267

Berea a town 90 m se of Louis

ville where Cumberland foothills

meet Bluegrass region pop 3372

seat of Berea College map K-31

Berea Ohio city 12 mi sw of Cleve-

land pop 12 051 Baldwin Wallace

College map A 357

Berea (college at Berea O) founded

1855 elementary secondary nurs-

ing and college of arts and sci-

ences agriculture business ad-

ministration home economics mu-

sic co operate plan of work and

study

Berent s (ber isen) wife of Ptol-

emy III Evergetes It is said that

her hair which had been pledged to

the gods for her husband's safe

return from Syria was carried to

her on from the Temple of Venus

and became the constellation Coma

Bere sa (Berens sa har)

constellation of stars S 376 380

Berensia Libya See in Index Bengasi

Berensford Charles William first

Baron (1846-1919) English ad-

ministrator member of Parliament

and author leader of b'n navy party

Berensford John Davys (1873-1947)

English author abandoned archi-

tecture for literature novels dis-

play keen psychological insight

(The Lary History of Jacob Stahl;

These Lynkers The Old Peo-

ple Po knower)

Berg Athens (1855-1935) Austrian

composer extreme modernist

(Woze i Lulu operas)

Bergamo (ber ga mo) Italy pictur-

esque town 20 mi ne of Milan

pop 102 553 notable old churches

silk and other textiles map E 425

Bergamot a kind of mint M 291

explosive seed pods B 98

Berken Flear (born 1893) ventrilo-

quist born Chicago Ill Chautau-

ques entertainer 1922-25 vaudeville

in US and Europe 1928 36 later

radio and television actor famous

as voice of wooden dummy Charlie

McCarthy

Bergen (berg un) Norway ex of port

on sw coast pop 114 845 exports

fish and fish products shipbuild-

ing N 30° maps N 331 E 424

fish market picture N 304a

rainfall A 302

Bergenfield N J borough across

Hudson River from New York City

pop 17 647 map i art N 164

Bergen op Zoom (ber ken op zom)

Netherlands old town on Zoom 20

mi n of Antwerp pop 26 442

famous as scene of many eges

Berger Victor Luitpold (1860-1909)

American Socialist political leader

born Nieder Reubach Austria

Hungary edited Social ist journals

M'waukee first Socialist ever

elected to Congress (1910) because

of pacifist preaching during World

War I excluded from Congress and

sentenced to 20 years imprison-

ment decision was reversed by Su-

preme Court and he was seated

1923

Berger Cyrano de See in Index

Cyrano de Bergerac Savinien

Bergh (berf) Henry (1811-88)

philanthropist and author born

New York City H 443

Bergius (ber gi us) Friedrich (1834-

1909) German chemist developed

processes for converting coal into

u=French u German u pen so til then A=French nasal (A) sh=French f (A in azure) K=German guttural ch

- in chemistry 1931 with Dr. Karl Bosch.
- Bergman, Ingrid** (born 1916), Swedish actress, born Stockholm; played in motion pictures and on stage in Europe and U.S.; motion-picture Academy award for 'Gaslight', 1944 (motion pictures: 'For Whom the Bell Tolls', 'Intermezzo'; 'Joan of Arc'; stage plays: 'Anna Christie'; 'Joan of Lorraine').
- Bergson** (bêrj-sôn'), **Henri** (1859-1941), French philosopher: denied claim of science to explain universe on mechanical principles; regarded life not as something static, but a matter of time and chance, unending creation (creative evolution); awarded Nobel prize in literature 1927 ('Time and Free Will'; 'Matter and Memory'; 'Creative Evolution'; 'Laughter'; 'The Creative Mind'); F-289
- Beria** (bê'ri-yâ), **Lavrenti P** (arlovich) (1899-1953), Russian political leader, born Georgian S.S.R.; elected to Central Committee of Communist party 1934; minister of internal affairs 1938-46 and 1953; became alternate member of Politburo 1939, full member 1946; promoted to marshal in world War II; a deputy premier 1941-53, a first deputy premier 1953; convicted of treason and shot; R-292a, picture R-292a
- Beriberi** (bêr'î-bêr'î), nervous disease caused by vitamin deficiency V-494, 497, 498
- Bering** (bê'ring), or **Behring**, **Vitus** (1680-1711), Danish navigator, commissioned by Peter the Great to explore n.e. Asiatic coasts for Russia; B-125, A-137
- Bering Sea**, arm of North Pacific Ocean between Alaska and Siberia B-125, maps N-250, 245, A-135, A-406, 411. See also in *Index Ocean, table*
- declared open ocean C-101, B-125
- seal fisheries arbitration S-90, H-276
- seals S-89-90, A-134
- Bering Sea Arbitration Treaty** (1891). See in *Index Treaties, table*
- Bering Strait**, channel separating Asia and North America and connecting North Pacific with Arctic Ocean B-125, maps N-250, 245, A-135
- Bériot** (bê'rî-ô'), **Charles Auguste de** (1802-70), Belgian violinist and composer; married singer Mme. Malibran; many compositions and a 'Method' for violin students. His son, **Charles Vilfride de Bériot** (1833-1914), a noted pianist.
- Berkeley** (bêrk'li), **George** (1685-1753), English idealistic philosopher who maintained that matter has no existence independent of mind; political economist, writer, and Anglican bishop ('Essay Towards a New Theory of Vision'; 'Treatise Concerning the Principles of Human Knowledge'); E-245
- Berkeley, Calif.**, named for B-125
- Berkeley, John**, baron of Stratton (died 1678), grantee of New Jersey N-167
- Berkeley, Sir William** (1606-77), tyrannical and extortionate English governor of Virginia V-489
- suppresses Bacon's Rebellion B-11
- Berkeley (bêrk'li)**, Calif., city on e. shore of San Francisco Bay, opposite the Golden Gate; pop. 113,805; B-125, maps U-252, inset C-34
- University of California, picture C-43
- Berkeley Springs, W. Va.** See in *Index Bath, W. Va.*
- Berkellum**, chemical element, *tables* P-151, C-214
- Berkley, Mich.**, city 14 ml. n. w. of Detroit; residential suburb; pop. 17,931; map, inset M-227
- Berks**, or **Berkshire**, agricultural county in England, s. of Thames River; 725 sq. ml.; pop. 402,939; county seat Reading; map E-347
- Berkshire Hills**, in w. Massachusetts M-137, maps M-124, 132
- Berkshire hog** H-404, pictures H-403, I-85
- Berkshire Music Center**, Tanglewood (estate), Lenox, Mass.; founded by Serge Koussevitzky 1910; summer music school for advanced students about to enter professional careers and for general students and music lovers; operated by Boston Symphony Orchestra in conjunction with its Berkshire Music Festival.
- Berkshire Music Festival**, Tanglewood (estate), Lenox, Mass.; originated at Interlaken, Mass., 1934, by Henry K. Hadley; taken over by Boston Symphony Orchestra at Tanglewood, 1936; now six weeks of concerts, July-August.
- Berlage** (bêr'lâ-kê), **Hendrik Petrus** (1856-1934), Dutch architect; with brick as favorite material developed a simple, austere form which is now the characteristic architecture of modern Netherlands; architectural adviser to Amsterdam, The Hague, and Rotterdam.
- Berlioz** (bêr'lî-ô'), **Hector** (1803-69), French musical composer, born near Grenoble; went to Paris to study medicine, but gave it up for music; brilliant romanticist; considered father of modern orchestration; wrote 'Treatise on Instrumentation', a standard work ('Symphonie Fantastique'; 'Damnation de Faust'; 'Roméo et Juliette').
- Bermelo** (bêr-mâ'hô) River, in n. Argentina; flows s.e. about 1090 mi.; A-332, map A-331
- Bermuda grass**, a hardy, creeping grass (*Cynodon dactylon*), grown in warm climates for lawns and pastures. Grows to 1 ft.; blossoming spikes bear dark purple florets. Also called wire grass.
- Bermuda Lily** L-242, picture F-182
- flower structure, pictures F-182, 183
- Bermuda onion** O-383
- Bermudas**, group of islands in Atlantic Ocean; 19 sq. mi.; pop. 37,402; B-130-2, maps N-251, inset W-96a, pictures B-130-2
- great circle distance to and from, map A-531
- U. S. air and naval base B-130
- Bernadete** (bêr-nâ-dê), **Juan de**, Spanish navigator; discovered the Bermudas about 1515.
- Bern** (bêrn), also **Berne**, capital of Switzerland; pop. 146,499; B-132, S-479, maps S-475, E-425, 416, picture S-482
- Universal Postal Union P-389; monument, picture P-388
- Bernadette of Lourdes** (bêr-nâ-dêl ôv lôrd), real name Bernadette Soubirous (sô-bê-rô) (1844-79), peasant girl of Lourdes, France; her visions of Our Lady at Lourdes, in which miraculous powers were promised to water of Lourdes, led to establishment of shrine; joined Sisters of Charity at Nevers 1866; took perpetual vows 1878; canonized 1933; feast day Feb. 18; L-336
- Bernadotte**, (bêr-nâ-dôt'), **Folke** (1895-1948), Swedish count and diplomat; promoted Swedish-American relations; peace mediator in World War II; appointed United Nations mediator between Israel and Arabs 1948; assassinated in Jerusalem Sept. 1948.
- Bernadotte, Jean Baptiste Jules** (1763-1644), French general; distinguished himself in Napoleonic wars; made marshal of France; elected crown prince of Sweden 1810; succeeded in annexing Norway to Sweden and ruled over both countries as Charles XIV (1818-44); the present reigning house of Sweden is descended from him; S-466
- Bernanos** (bêr-nâ-nôs'), **Georges** (1888-1948), French writer, born Paris (novels: 'The Diary of a Country Priest' and 'Under the Sun of Satan'; political prose: 'Plea for Liberty').
- Bernard** (bêr-nâr'), **Claude** (1813-78), French physiologist, discoverer of digestive work of pancreatic juice, sugar-forming work of liver, and existence of vasomotor and vasoconstrictor nerves.
- Bernardin de Saint-Pierre** (bêr-nâr-dîn dê sâi-pyêr'), **Jacques-Henri** (1737-1814), French author; a friend of J. J. Rousseau, and, like him, a champion of the return to nature; broke away from stilted

Key: câpe, ât, fâr, fâst, what, fâll; mē, yêl, fêrn, thêre; îce, bît; rôw, wôn, fôr, nôl, dō; câre, bût, ryde, fyll, bûrn; out;

- vocabulary of French classical writing (Paul and Virginia)
- Bernardino (ber-nar'di-no) See *Index*
- Bernard (bér-nar'd) of Clairvaux saint (1080-1153), French monk one of most eloquent preachers of Midle Ages feast day August 20 opposes Albigens A 3 preaches Second Crusade C 520 picture C 521
- Bernard of Menton, Saint (1223-1308) French monk founded (about 962) the famous hospices conducted by Augustinian monks at the Great and Little St Bernard passes in the Alps In 1932 another such hospice was established at the St La Pass on the borders of Tibet and Szechwan Feast day June 15
- Berns (bérns) Gerhard D 132 See also *Index*
- Bernese mountain dog table D 118a
- Bernese Oberland (bér-né) Alps range in Switzerland map S 475
- Bernhardt (bérn-har'd) Friedrich von (1849-1930) German general and author in Franco-Prussian War and World War I in his Germany and the Next War (1912) preached doctrine of force also wrote World Power or Downfall
- Bernhardt of Lippe-Biesterfeld (born 1911) German prince the prince of the Netherlands consort of Queen Juliana N 122 picture N 121
- Bernhardt (bérn-har't, French bér-nar'd) Sarah (1816-1896) (1844-1923) French actress born in Paris of French and Dutch parentage baptized Christian at age of 12 made debut 1863 and continued to act almost up to time of her death her great emotional power rich voice grace and vivid personality made her one of the greatest actresses of all time among her favorite roles were Camille, La Tosca, Cléopâtre, and La Esclavage picture D 131
- Bernina (bér-ni-na) Pis. Alp. no peak in so Switzerland near Italian border (23 295 ft)
- Bernini (bér-ni-ne), Giovanni Lorenzo (1598-1680) Italian sculptor and architect of the baroque period, born Naples works brought him high reward during his lifetime most of work now regarded as extravagant and artificial (Apollo and Daphne) S 781 colonnade Rome pictures P 194 192, P 65
- Bernina in Rome P 195-6
- St Teresa S 781 picture S 78d
- Bernoulli (bér-no-yi) a Swiss family of noted mathematicians and scientists including Daniel Jakob and Johann
- Bernoulli Daniel (1700-84) Swiss mathematician and physicist wrote on problems of acoustics worked differential equations (Bernoulli equation) most important publication on hydrodynamics advanced kinetic theory of gases and fluids Bernoulli effect A 74 A 87-8 diagrams L 225 pictures A 75
- Bernoulli Jakob or Jacques (1644-1705) celebrated Swiss mathematician an voluminous writer on mathematics (Ars Conjectandi)
- Bernoulli Johann or Jean (1667-1748) Swiss mathematician born Basel did notable work in integral and exponential calculus (Johannis Bernoulli Opera Omnia)
- Bernstein (bérn-sh'ti-n) Edward (1890-1932) German moderate socialist and writer born Berlin S 216
- Bernstein (bérn-sh'ti-n) Henry (1876-1924) French dramatist, born Paris fine technical skill (The Three Days Judith Melis)
- Bernstein (bérn-sh'ti-n) Leonard (born 1918) pianist composer and conductor born Lawrence Mass a student conductor N Y 11 their union Symphony 1943-44 musical director N Y City Symphony 1945-48 (Jeremiah symphony Fancy Free ballet On the Town and Wonderful Town musical plays)
- Bernstein (bérn-sh'ti-n) Johann Heinrich count von (1862-1913) German diplomat an ambassador to U S 1911 active interest in League of Nations and in disarmament voluntary exile in Switzerland after 1917
- discovered by President Wilson W 234
- Berni or Berry (bér-ni) John duke of (1340-1416) 3d son of John II (king of France) though chivalrous and unscrupulous he was a patron of arts and letters I 132 B 232
- Berni or Berry historic French province N 270
- Berni Frick See *Index* Best
- Allena Chan plan
- Berry (bér-ri) Martha McMonney (1860-1914) American educator and philanthropist B 132 S 3
- Berry will fruit with seeds contained in July S 395 See also *Index* names of berries
- Berzobaber L 247
- Bernaghi (bér-nar-gi) corps of Italian assault troops noted for endurance and rapid marching wear cocks feathers in their hats
- Bernese clover C 380 E 275
- Berserk (bér-sérk) or Berserker in Scandinavian mythology a warrior who fought ferarly and wildly without armor 12 sons inherited name and same battling fury name later applied to bodyguards of Scandinavian leaders
- Bert Paul (1923-80) French physiologist and political leader noted for work on physiologic effects of a pressure work in anesthesia A 246
- Bertin a place in which to sleep airplane picture A 538
- Bertin car R 88 picture R 66
- Bertin nautical See *Index* Nautical terms table
- Bertha, or Bertrada (died 879) mother of Charlemagne celebrated in medieval legends called Bertha with the large foot because one foot was larger than other
- Berthelot (bér-tu-lo) Pierre Eugène Marcellin (1827-1907) French chemist founded synthetic chemistry that organic compounds may be produced outside of living bodies
- Berthelot (bér-tu-lo) Louis Louis Count (1748-1822) French chemist first physical chemist with Lavoisier contributed to modern chemistry and nomenclature
- Berti rade See *Index* Bertha
- Bertilin (bér-ti-n) Alphonse (1813-1914) French anthropologist devised system of measurements to identify criminals
- Berwick a borough on Susquehanna River 23 mi s w of Wilkes Barre pop 14 010 railway cars iron products silks flour map J 133
- Berwick-on-Tweed England frontier town at mouth of Tweed River on Scottish border pop 12 550 prominent in border wars map J 324
- Berwyn Ill residential suburb 10 mi w of Chicago pop 51 280 map I ver I 36
- Beryl a mineral J 343 N 266 table M 176
- Beryllium a chemical element A 268 tables P 151 C 214 M 176
- beryllium copper table A 174
- electric structure diagram A 458 C 213
- Beryllus (bér-ri-l) fairy in Maeterlinck's Blue Bird M 23
- Berzelius (bér-ze-le-ä) Jöns Jakob Baron (1779-1848) Swedish chemist discovered silicon zirconium cerium thorium and selenium invented chemical symbols atom weights C 222
- Bessone (bér-son) France fortified city on Doubs River 9 mi s e of Paris pop 51 97 watches clocks Roman remains birthplace of Victor Hugo maps S 475 F 270 L 423
- Best rayon factory P 76
- Best (bér-ä) Annie (1847-1932) English theosophist president Theosophical Society after 190 prominent in social and Indian nationalistic movements founded Central Hindu College 1898 and Central Hindu Girls School 1904 at Benares
- Bessant (bér-zant) Sir Walter (1836-1901) English author his stories of First London life notably All Sorts and Conditions of Men gave great impetus to social reforms also collaborated with James Rice
- Besler (bér-é) Rudolf (1878-1947) English dramatist collaborated with H G Wells in Kilps (1917) with Hugh Walpole in Robin's Father (1918) known in U S for The Barretts of Wimpole Street
- Beskow Elsa (born 1874) Swedish writer and illustrator of charming books for children first picture book The Tale of the Wee Little Old Woman (1897) among others are Aunt Green Aunt Brown and Aunt Lavender Pelle's New Suit
- Bessard (bér-nar) Earl Albert (1843-1944) French artist born Paris highly versatile noted alike as painter (of landscapes portraits and murals) and as etcher principles of impressionists employed in treatment of light and light but not in matter of realism
- Besavaria distr. acquired by Pumania 1918 taken by Russia 1940 17 146 sq mi pop about 3 000 000 R 291 R 254
- Bessborough Viscountess Ponsonby, 8th earl of (born 1880) governor general of Canada 1931-35 had been in British Parliament about 20 years a director of important business concerns
- Bessel Friedrich Wilhelm (1784-1846) German astronomer and mathematician S 371 372
- Bessemer Sir Henry (1813-78) English inventor of Bessemer process of making steel I 247 works at Sheffield S 138
- Bessemer Ala city 10 mi s w of Birmingham in Great Alabama coal and iron ore district map 28 44, A 116 maps A 128 U 253
- Bessemer converter I 243
- Bessemer steel process I 247, diagrams I 238 picture I 243
- first plant in U S to use T 193
- Bessey Charles Edwin (1844-1913) botanist born Wayne County Ohio taught botany Iowa Agricultural College 1880-84 professor of botany University of Nebraska after 1884 (dean and chancellor after 1905) pioneer in modern laboratory methods
- Best, Adena Champlin (born 1899) pen name Frick Berry author and illustrator of children's books

- born New Bedford, Mass. ('Winged Girl of Kno-sos', ancient experiments in flying; 'Homespun', aspects of pioneer life. 'Sibil Ludington's Ride', based on episode in Revolutionary War); editor, 'Land of the Free Series', teen-age novels about racial and national groups that have enriched American life.
- Best, Charles Herbert** (born 1899). Canadian physiologist B-53, picture B-53
- Best, Herbert** (born 1894). English author, born Chester, England, in government service in West Africa books for children are illustrated by his wife, Allena Champlin Best ('Garam the Hunter'; 'Not Without Danger'; 'Watergate').
- Besterman, Catherine** (born 1908). American author, born Poland; escaped from there at outbreak of World War II, reached U S and became American citizen. Children's book ('The Quaint and Curious Quest of Johnny Longfoot, the Shoe King's Son') is an old Polish folk tale adapted for American children.
- 'Best Friend of Charleston'** one of first locomotives built in America F-59, T-172, picture L-293
- Beston, Henry** (originally Henry Beston Sheahan) (born 1888). writer, born Quincy, Mass.; adventure stories, fairy tales ('Firelight Fairy Book'; 'The Book of Gallant Vagabonds'; 'The Sons of Kai'; 'The Outermost House', 'The Tree That Ran Away').
- Be'ta Centauri**, a fixed star S-372
- Beta particles** (or rays) R-53-4, N-332, chart R-54b, pictures R-52 emission process R-54d-5, picture R-54d
- Betatron**, electron (beta-ray) accelerator A-462a, X-332, picture A-462a
- Betel** (*bē'til*), a palm B-133 nut, picture N-317
- Betelgeuse** (*bē'tēl-jūz*), also *Betelgeuse* or *Betelgeux*, a fixed star S-373, 382, charts S-373, 379, 381, diagram S-372
- Beth'any**, village near Jerusalem often mentioned in Gospels; home of Mary, Martha, Lazarus, map B-138
- Bethany College**, at Bethany, W. Va.; founded 1840; affiliated with Disciples of Christ; arts and sciences.
- Bethany College**, at Lindsborg, Kan.; Lutheran; founded 1881; arts and sciences, education, fine arts.
- Bethel**, Pa., borough in Allegheny County, 8 mi. s.w. of Pittsburgh; pop. 11,324; map, inset P-132
- Bethel**, Palestine, village ('house of God') 10 mi. n. of Jerusalem (Gen. xli, 8; xxviii), map B-138
- Bethel College** (Kan.), at North Newton; Mennonite; founded 1887; arts and sciences, applied arts, education, music, theology.
- Bethel College** (Tenn.), at McKenzie; controlled by Cumberland Presbyterian church; open 1842; arts and sciences, education.
- Bethesda**, pool in ancient Jerusalem referred to in the Bible (John v, 2-4) as having miraculous healing qualities.
- Bethlehem**, Pa., city about 50 mi. n. of Philadelphia, on Lehigh River; pop. 66,340; iron and steel works; textiles, chemicals; Lehigh University, Moravian College (for men), Moravian College for Women; founded by Moravians; scene of annual Bach music festivals; map P-133
- Bethlehem**, Palestine, birthplace of Jesus; pop. 9000; B-133, maps B-138, I-256, P-45, color pictures C-291-2
- Christmas** in C-291-2
- Bethmann-Hollweg** (*bē'tmān-hōl'vāk*), Theobald von (1856-1921), German statesman, imperial chancellor (1909-17) W-218
- Bethshan** (*bē'th'shān*), or Beth-shean (*bē'th-she'an*), ancient city in Palestine, 55 mi. n.e. of Jerusalem on site of modern Beisan (*bā'sān*). Israel; Egyptian, Canaanite, and Roman remains; recent excavations include two Egyptian temples built 13th century B.C., in which head and armor of Saul were laid (1 Chron. x, 10); map I-256
- Bethune, David**. See in *Index* Beaton, David
- Bethune** (*bē'thūn*'), John (1751-1815). Canadian clergyman, born Isle of Skye, Scotland; in 1786 he founded at Montreal the first Presbyterian church in Canada.
- Bethune, Mary McLeod** (1875-1955), Negro educator born Mayesville S. C.; president 1904-42, later president emeritus, Bethune-Cookman College, famous for its extension work among Negroes: W-165
- Bethune-Cookman College**, Daytona Beach, Fla.; Methodist; founded 1872 at Jacksonville; moved to present site 1923; arts and sciences.
- Bet-pak-dala**, a desert in Russia R-261
- Betta splendens**, or Siamese fighting fish A-281, color picture F-105
- male builds and guards nest F-106, picture F-106
- Better Business Bureaus**, agencies for promoting honesty, accuracy, and dependability in manufacture and distribution of all commodities; first agency established Minneapolis, 1914.
- Bettina**. See in *Index* Ehrlich, Bettina
- Betty lamp**, or Phoebe lamp L-88, picture A-203
- Betulaceae** (*bē't-yū-lā'sē-ē*), the birch family, including birches, hazels, and alders.
- Beuthen** (*boi'tēn*), or Bytom (*bī'tōm*), Poland, former German mining and industrial town in Upper Silesia; included in Poland since 1945; pop. 120,693.
- Bevan, Aneurin** (*ān-'vīn bē'vān*) (born 1897), British left wing Labor party leader, born Tredegar, Monmouth, England; a miner at 13; member of Parliament since 1929; minister of health 1945-51; minister of labor Jan. to April 1951, resigned; author of 'In Place of Fear'.
- Bevatron**, proton accelerator A-462b, diagram A-462b, picture A-462b
- Bevel**. See in *Index* Architecture, table of terms
- Beverages**. See also in *Index* Coffee; Milk; Tea
- alcoholic A-145-6
- carbonated W-64
- cocoa and chocolate C-288, 289
- plants provide P-301
- soft drinks P-301
- Beveridge, Albert Jeremiah** (1862-1927), political leader, lawyer, and author, born near Hillsboro, Ohio; U. S. senator (Republican) from Indiana 1899-1911 ('Life of John Marshall'; 'Abraham Lincoln').
- Beveridge, William Henry**, Baron (born 1879), English economist and sociologist; noted for plan for post-war social security, brought out in December 1942, which would provide compulsory state insurance protecting every person in Great Britain throughout his lifetime from want or insecurity
- security program based on plan S-218a
- Beverly**, Mass., city and summer resort n. Salem on Salem Bay; pop. 28,884; shoe machinery and shoes; distributing point for Texas oil; map, inset M-132
- Beverly Hills**, Calif., beautiful residential city, surrounded by city of Los Angeles; pop. 29,032; home of many motion-picture stars; map, inset C-35
- Beverwyck**, original name of Albany, N. Y. A-139
- Bevin, Ernest** (1881-1951), British statesman and trade union leader; secretary of Dockers' Union 1911; general secretary of Transport and General Workers' Union 1922; member of general council of the Trades Union Congress 1926, chairman 1937; minister of labor 1940-45; foreign secretary 1945-51; became lord privy seal March 1951.
- Bevis** (*bē'vīs*), John (1695-1771), English scientist E-307
- Bevick** (*bē'vīk*), Thomas (1753-1828), English wood engraver; illustrated many books on animals ('Quadrupeds'; 'British Birds'; 'Aesop's Fables'); E-386, L-270, P-211
- Bexley**, Ohio, city adjoining Columbus on s.e.; residential; pop. 12,378; map O-357
- Bey** (*bā*), hereditary title of native sovereign of Tunisia; formerly title of nobility in Turkish Empire Tunisia T-207
- Beyle, Marie Henri**. See in *Index* Stendhal
- Beyoglu** (*bē-ē-ō-lū'*), also Pera, suburb and foreign quarter, Istanbul, n. of Golden Horn, map I-258
- Beyrout**, Lebanon. See in *Index* Beirut
- Bezant**, gold coin of Byzantine Empire, value about \$2.42.
- Béziers** (*bāz-yā'*), France, cathedral town and trade center near s. coast about 38 mi. s.w. of Montpellier; pop. 59,894; massacre of Albigenses in 1209; map E-425
- Bhagavad Gita** (*bāg'rād gē'tā*), a Sanskrit dramatic poem forming part of the Mahabharata.
- Bhakra Dam**, in India, on Sutlej River. See also in *Index* Dam, table
- Bhang**, Indian name for hashish N-13
- Bhils** (*bē'lz*), savage dark-skinned people of central India I-56
- Bhilsa** (*bī'l'sā*), village in central India over 30 mi. n.e. of Bhopal; famous for old Buddhist memorial shrines (topes); principal one, Sanchi, 6 mi. from village.
- Bhopal** (*bō-pāl*), a state of central India; formerly a Moslem state; area 6878 sq. mi.; pop. 836,474; state was ruled 1844-1926 by women (begums, or princesses); Sultan Jahan Begum (1858-1930) did much to advance position of women, education, and medical aid; in 1926 abdicated in favor of son; state acceded to India 1947; cap. Bhopal (pop. 102,333); map A-407
- Bhutan** (*bo-tūn*'), state in e. Himalayas between Tibet and India; 15,000 sq. mi.; pop. 300,000; agriculture, stock raising; cap. Bhumthang; maps I-54, 68a, A-407
- Biafra** (*bē-ā-fra*), Bight of, large bay on w. coast of Africa at head of Gulf of Guinea.
- Bialik** (*bē-ā'lik*), Chaim Nachman (1873-1934), Jewish poet, born in Russia; lived in Palestine after 1923; called poet laureate of the Jewish Renaissance; compiler of old Hebrew poetry and folklore; wrote in Hebrew ('The Talmudic Student'; 'The City of Slaughter').

Key: cape, *dt.* fār, fāst, whgt. fāll; *mē*, yēt, fērn, thāre; *ice*, bit; *rōw*, wōn, fōr, nōt, dō; *cūre*, bāt, ryde, fyll, būrn; *out*:

Bialystok (bydł H 266k) Polish city
100 mi ne of Warsaw pop
65 769 manufactures textiles
leather hats coal maps L 424 417
Blanco (be pan 16) Margery Williams
(1881-1944) writer born London
Eng and marrd Francesc D an
co of Italy 1904 lived in France
and Italy before moving to New
York City her books include The
Velveten Fahhl the first of more
than 30 books she wrote for chil
dren and young people The Little
Wooden Doll illustrated by her
daughter Pamela at the age of 14
All About Pets "Winterbound"
"Forward Commandos"
Blanco Pamela (born 1906) artist
and author born London daughter
of Margery Blanco held art ex
hibits in Europe and U S has
illustrated work of other authors
and the following books of her own
Starlit Journey Little Flowers
Far Away Look Inside Easter
Egg pictures L 213, 214
Blarris (de o-rets) France resort
on Bay of Biscay near Bayonne
pop 20 447 summer residence of
Napoleon III and his empress Eu
genie maps B 259 F 425
Blas one of Seven Wise Men of
Greece S 233
Blas in sewing S 115
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- Bibliophile**, a lover of books B-246
Bibliothèque Nationale (*bī-bli-ō-tēk-nās-yō-nāl'*), national library of France L-182
Bicameral legislature S-385
Bicarbonate, an acid salt of carbonic acid in which the radical (CO₃) is combined with an atom of hydrogen and a metal, also called acid carbonate
ammonium A-236
soda (baking soda) A-10, S-225, 226; baking powder B-18, 19
Biceps muscles M-453, pictures M-454
Bichat (*bī-shā'*), Marie François Xavier (1771-1802), French physiologist and anatomist; modern histology based on his research on body tissues
Bichloride of mercury. See in *Index*
Mercuric chloride
- Bickerdylke**, Mary Ann Ball (Mother Bickerdylke) (1817-1901), nurse, born Knox County, Ohio; famous for work among sick and wounded during Civil War; spent life after war working in service of others; monument to her in Galesburg, Ill., where she lived several years.
Bickertstaff, Isaac, pen name of Richard Steele as editor of the *Tatler*; previously used by Jonathan Swift.
Bicuspid valve H-312, color picture H-312
Bicycle and motorcycle B-141-3, pictures B-141-2, V-423, 429, N-120
safety measures S-10-11
Wheelmen of America R-158d
Bidault (*bē-dō*), Georges (born 1899), French government official, born Moulins; history teacher and newspaper editor until World War II, when he became leader of underground; foreign minister in provisional government 1944-46, president June-Dec. 1946; foreign minister 1947-48 and 1953; premier 1949-50; vice-premier 1951-52.
Biddeford, Me., city 15 mi. s. of Portland, 5 mi. from sea on Saco River; pop. 20,836; summer resort; cotton goods, lumber, shoes; settled in 1630; maps M-53, U-253
Biddle, A(ntonny) J(oseph) Drexel, Jr. (born 1897), U. S. Army officer and diplomat, born Philadelphia, Pa.; minister to Norway 1935-37; ambassador to Poland 1937-40; representative to exiled governments in London 1941-44; deputy chief of staff for national affairs (SHAPE) 1951-53; special assistant to Army chief of staff 1953-55; retired as brigadier general 1955.
Biddle, Francis (born 1856), American lawyer and public official, born Paris, France, of American parents; U. S. solicitor general 1940-41; U. S. attorney general 1941-45.
Biddle, George (born 1885), painter, lithographer, and writer on art, born Philadelphia, Pa.; best known for penetrating, sometimes satirical, portraits and for mural panels.
Biddle, John (1615-62), English religious teacher, sometimes called founder of Unitarianism; repeatedly imprisoned for his heresy, and finally died in prison.
Biddle, Nicholas (1786-1844), statesman, financier, and author, born Philadelphia, Pa., U. S. representative 1810-11; president of second Bank of the United States 1822-36, wrote 'History of the Expedition of Captains Lewis and Clark'.
Bidwell, John (1819-1900), rancher in Calif., born Chautauqua County, N.Y., in Mexican War, elected to Congress in 1864, Prohibition party candidate for president of U.S. 1892.
Biedermeyer (*bī'dēr-mi-ēr*), name given to a style of furniture originating in Germany in early 19th century; simple and architectural.
Bielefeld (*bī'le-fēld*), Germany, manufacturing town, 58 mi. s.w. of Hanover; pop. 153,618; map E-424
Biencourt de Poutreincourt, Jean de, baron de St. Just (died 1615), Canadian soldier and colonizer, born Picardy, France; 1603 joined colonization expedition to Acadia; 1606 took part in Champlain's explorations of Bay of Fundy.
Bienne (*bī-ēn'*), or Bieler, lake in Switzerland, near Bern; at foot of Jura Mts.; about 20 sq. mi.; contains island of St. Pierre, residence of Jean-Jacques Rousseau in 1765.
Bien'ial plants P-290, 297-8
in gardens, table G-16-17
Bienville (*bī-yān-rēl'*), Jean Baptiste le Moyne, sieur de (1650-1768), French-Canadian soldier and colonial officer, member of famous Le Moyne family B-143, picture B-143
Bierce, Ambrose (1842-1914?), writer, born Meigs County, Ohio; served in Civil War; journalist in London and later in California; went to Mexico and disappeared, 1914, conflicting accounts given of his death; skillful writer of short stories, especially of fantastic, supernatural tales in style of Poe; wrote satirical verse and essays; called "bitter Bierce" because of cynical attitude ('In the Midst of Life'; 'Can Such Things Be?')
quoted A-230
Bierstadt (*bēr-stāt*), Albert (1850-1902), American landscape painter of Hudson River School; born Solingen, Germany; famous for mountain scenes and historical paintings.
Bifocal lens, in spectacles S-330
Benjamin Franklin's, picture I-200
Big Belt Mountains, in w.-central Montana, e. of Helena, map M-374
Big Ben, great bell in Westminster clock tower, London, England L-304, picture G-173
clock size and mechanism W-56
Big Bend National Park, in Texas N-30, map N-18, picture N-31
Big Bend State, popular name for Tennessee T-57
Big Bertha, German siege gun A-398
Big Black Mountain, a peak of the Cumberland Mts. in Harlan County, s.e. Ky.; highest point in state, 4150 ft.; map K-31
Big Black River, in w. Mississippi, flows through rich cotton-producing plain to Mississippi River, about 250 mi.; maps M-296, 302-3
Big Blue River, rises in Nebraska, flows s. into Kansas; flows into Kansas River at Manhattan; about 300 mi. long; maps N-103, K-11
Big Brother Movement, an association of socially minded business and professional men who as volunteers help and encourage maladjusted and predelinquent boys; founded in New York in 1904 by Ernest K. Coulter; each city agency is independent; organization provides summer camps, clubs, vocational guidance and health programs.
Big-cone spruce, rare evergreen tree (*Pseudotsuga macrocarpa*) of pine family, native to mountains of s. California and Mexico. Grows 30 to 60 ft. high in dry, rocky places, at 3000 to 5000 ft. altitudes. Similar to Douglas fir. Branches long, drooping; leaves blue-green. Wood used as firewood.
Big Cypress Swamp, in s.w. Florida F-163, color picture P-291, maps F-151, 159, U-277
stork rookery S-402
Big Dipper, seven bright stars in the Great Bear constellation, charts S-374, 376-7, 379-80
use in telling time and direction, diagrams A-429
Bigelow, Erastus Brigham (1814-79), inventor, born Worcester, Mass. carpet-weaving machine R-252
Bigelow, John (1817-1911), journalist and diplomat, born Bristol, now Malden, N.Y.; managing editor *New York Evening Post* 1849-51; minister to France 1864-67; discovered original manuscript of Benjamin Franklin's 'Autobiography' and edited first complete edition ('Retrospections of an Active Life').
"Big Five", in United Nations U-240a
"Big Four", See in *Index* Railway brotherhoods
Big Hole Battlefield National Monument, in Montana N-30, map N-18
Big Horn, Rocky Mountain sheep B-143-4, picture B-144, color picture N-260
allied species S-136
altitude range, picture Z-362
Big Horn Mountains, range of Rocky Mts. in Wyoming and Montana; many peaks, mountain lakes, and waterfalls; highest point, Cloud Peak (13,165 ft.); maps W-316, 322-3, U-296
Big Horn River, in Wyoming and Montana; formed by junction of Popo Agie and Wind rivers in Fremont Co. in central Wyoming; flows 335 mi. n. into s.-central Montana where it joins Yellowstone River; maps W-316, 322, M-367, 375, U-296
Boysen Dam W-316
Bight, of rope K-60, picture K-61
Bigleaf maple, tree (*Acer macrophyllum*) of maple family, native from British Columbia, Canada, to California. Grows 30 ft. to 100 ft. Leaves, heart-shaped with 3 to 5 lobes, 8 in. to 18 in. long. Flowers yellowish green, in drooping clusters. Wood medium hard, used for veneer and lumber; tree and wood sometimes called Oregon maple.
Big Lick, early name of Roanoke, Va. R-162
'Big' Low Papers, 'The', series of dialect poems by James Russell Lowell, in which he speaks through imaginary author, Hosea Biglow, shrewd, humorous Yankee: L-338, A-226c

Key: cāpe, āt, fūr, fust, whāt, fūll; mē, yēt, fērn, thēre; fce, bīt; rōw, wōn, fōr, nōt, dē; cōre, bīt, rīde, fūll, bārn; out;

Bignonia (*bī gō nē-ō*) genus of perennial tropical plants trumpet shaped red yellow and purple flowers called corolla vine (a cut stem shows a cross pattern) not to be confused with trumpet vine genus

Bignoniaceae (*bī gō nē-ō-ē*) also called the trumpet creeper family, a family of plants shrubs vines and trees native chiefly to warm regions including bignonia catappa trumpet flower jacaranda cape honey suckle flowering willow and calathra tree

Bigo (*bē gō*) François (flourished 1793) 1) Intendant of New France (Canada) (1744-59) born Bordeaux France corrupt and tyrannical ruler 1759 arrested in France imprisoned and banished from kingdom

Big River in Quebec Canada rises in central part, flows w 500 mi to James Bay

Big Sandy River tributary of Ohio River with e branch (Tug Fork) forms Kentucky West Virginia boundary maps W 100 K 23 31

Big Sioux River flows s (300 mi) through fertile plains of South Dakota, forming boundary between Iowa and South Dakota for last part of its course maps S 296 303

Big Spring Tex. city in w 203 mi s of Amarillo pop 17 236 oil producing and refining agriculture stock raising cotton railroad shops maps T 80 U 252

Big Stick policy of President Theodore Roosevelt M 355

Big Lake forms part of boundary between Minnesota and South Dakota 2 mi long and 3 mi wide R 33 maps S 296 303

Big Ten formerly Big Nine the Western Conference in football F 231

Big Thompson River rises in Colorado s Rocky Mountains w of Estes Park flows into South Platte River near La Salle Colo length 73 miles map C 408-9

Colorado Big Thompson project C 414a-1 I 251

Bigtree the Washington or giant sequoia S 101 2 picture S 102 See also Index Sequoia

Big White (1765-1810*) Mandan Indian chief aided Lewis and Clark Expedition received a medal and a trip to Washington, D.C., in 1806

Bihar (*bē ār*) state in n India area 70 330 sq mi pop 40 725 497 cap Patna rice corn mica iron ore coal maps I 58a

Bihzad, also Behzad (1460?-1524*) Persian miniature painter active 1478 1500 master colorist painted realistically called marvel of the age notable influence on subsequent Persian art

Bikaner (*bē k ā nēr*) India city in n Rajasthan state on Thar Desert about 230 mi s w of Delhi pop 117 113 map A 407

Bikini northernmost atoll of Ralik group Marshall Islands atoll is 45 mi long 15 mi wide perimeter 65 mi includes Bikini Enyu Enrikku and Namu islets in July 1947 scene of two atomic bomb tests one aerial and one under water before tests inhabitants were transplanted in 1954 an H bomb was exploded nearby map P 16

Bilaspur (*bī ā spē pur*) state in n India area 453 sq mi pop 125 099 cap Bilaspur formerly one of the Punjab Hill States map I 48a

Bilbao (*bī ā bō*) chief seaport of n Spain on Nervion River 8 mi from Bay of Biscay pop 229 334 with suburbs exports iron ore from

new bvt mines long famous for steel rods blades (called bilbos) n ps S 312 L 425

Bilberry (blueberry) B 211

Bilal one of Job's friends a Shuhite who false y comforted him with words without knowledge

Bilderdyk or Bilderdijk (*bī dōr dē k*) Willem (1759-1831) Dutch poet philologist philosopher became librarian of Louis Napoleon and later president of the Royal Institute (The Decease of Genius The Destruct on of the First World)

Bile a secret on of the liver L 77

Bile duct L 277

Bike See Index Nauti al terms table

Bill Alfred Hoyt (born 1879) writer born Rochester N Y Army captain and regimental adjutant 1916-18 captain American Expeditionary Force F 1918 boy hero of First World War Clutch of the (cor can)

Bill in l. S. C. negroes how it becomes a law C 435a 436 pictures C 435b

Bill of birds color picture B 176

Billie steel 44 248

Billiards B 144 picture B 144

Billie's doll D 122

Billings Josh pen name of Henry Wheeler Shaw (1818-85) humorist, born Lanesborough (Lanesboro) Mass for many years a farmer a duncer once said it's better not to know so many things than to know so many things that ain't so

Billings Warren K. (born 1894) labor leader with Thomas J. Mooney imprisoned for bombing in San Francisco 1916 sentence commuted 1939 C 49

Billings Willam (1746-1800) singing teacher tanner by trade born Boston Mass pioneer in American music exerted influence upon early throat music

Billings Mont city on Yellowstone River in s pop 31 834 oil wells nearby petroleum refining rail road repair shops best sugar refining livestock marketing food processing metal products Rocky Mountain College Eastern Montana College of Education M 377 maps M 375 U 252

Billingsgate London's famous fish market near London Bridge hence coarse and abusive language such as is heard there E 354

Bill of attainder See in Index Attainder

Bill of exchange C 598-10 F 235 international trade I 195

Bill of lading a written acknowledgment of goods received for transportation issued by the master of a ship acts as a contract to deliver the goods when sued by a railroad such a bill is called a waybill

Bill of rights

English B 145 E 368

French declaration of rights B 145 F 203

state constitutions A 395 B 145 United Nations U 242 243 B 145 U S Constitution B 145 U 348

original document preserved in U 345 Patrick Henry secures adoption H 340 text U 355-4

Bill of Rights G I See in Index G I Bill of Rights

Bill of sale a formal written statement of the sale of personal property necessary when transfer of property does not occur at once

Billie the kid (William H. Bonney) (1859-81) outlaw of the South west, born New York City spent early life in Kansas and Colorado and about 1865 moved to New

Mexico became leader of an outlaw band in various cattle wars and made a record of 21 killings finally shot and killed by Sheriff Pat Garrett at Fort Sumner N M F 202, 204

Biloxi (*bī ā lō-ē*) tribe of Souse Indians some of whom still live in Louisiana others with the Choctaw and Caddo in Oklahoma

Biloxi Mies city in s on peninsula between Bixby Bay and Miesia point Sound Gulf of Mexico pop 37 422 resort area fishing port (shrimp and oysters) sea food cannery and packing center boatbuilding houses Air Force Base US Veterans Hospital settled in 1899 by Iherlve one of first permanent settlements in Mississippi Valley n ps M 303 L 253

Bismuth M 338 See also in Index Bismuth

Bismut (*bī m-ut*) fabled island in the Phama group sight by Ponce de Leon P 368

Bimini a so Bimlins The group of small islands in the Bahamas about 40 m e of Florida consists of 2 main islands and a few smaller ones only North Bimini is inhabited area 8 sq mi pop 718 n ps B 17 W 96

tin fish net T 205

Binary (*bē n-ē*) stars or double stars S 370

Bladder twine sial used for S 190

Binding force of atom A 464

Binding of books E 240-1 See also in Index Bookbinding

Blindweed See in Index Morning glory subkind wild

Blot (*bē nē*) Alfred (1857-1911) French experimental psychologist made study of hypnosis and psychological psychology but chiefly known for his efforts to measure human intelligence P 427b I 171

Blot Simon tests I 171

Blond Rudolf (born 1900*) operatic impersonator English citizen born Vienna Austria artistic director Pittsburgh (s island) Festival 1947-49 general manager Glyndebourne Opera (England) 1934-49 appointed general manager Metropolitan Opera Association (New York City) May 1949

Blengen (*bē mē n*) Germany town on Rhine River 15 mi w of Mainz river trade city was historic buildings nearby on a rock in Rhine is Mauserturm (Mouse Tower) where legend says Arch Bishop Hatto was devoured by mice for betraying his subjects

Bingham (*bī ng ā m*) George Caleb (1811-79) painter and political leader born Augusta County Va lived in Missouri from boyhood and painted popular scenes and characters often political state treasurer 1867-65 adjutant general 1871

Bingham Hiram (born 1875) explorer and U S senator born Honolulu Hawaii directed Peruvian expeditions for Yale University and National Geographic Society 1911-15 explored ruins of Machu Picchu and Titicaca last Inca capital U S senator from Connecticut 1924-33

Bingham Canyon or Bingham Utah, mining town 20 mi s w of Salt Lake City pop 2669 map U 416 copper mine U 409 C 474, picture U 419

Bingham Parcel two tracts of land in Maine each of one million acres between Penobscot and St Croix rivers offered at lottery by Massachusetts 1786 William Bingham, a Philadelphia banker was largest purchaser

Binghamton, N. Y., city at junction of Susquehanna and Chenango rivers about 65 mi. s. of Syracuse; pop. 80,674; photographic supplies, aviation training equipment, shoes, furniture: maps N-205, U-253

Binhduh (bin'y'-din'y'), town in Annam, Indo-China, pop. 75,000; near e. coast 10 mi n. of its port Quinhon, or Kwinhon (kwi'-nyon'), a shipping center for rice, sugar, cotton maps I-123, A-407

Bin'nacle, a case or stand for ship's compass C-428, picture C-429

Binocular, field glass T-48

stereoscopic principle S-392

Binocular vision E-460, S-392, S-100

Bino'mial, from Latin, "double name" algebra A-163

biology, nomenclature L-254

Binyon, Laurence (1869-1943). English poet, art historian and literary critic; in charge of oriental prints and drawings. British Museum ('The Four Years', war poems; 'Poems of Nizami' 'Boadicea', drama; 'Painting in the Far East' and 'The Flight of the Dragon', works on oriental art)

Bio-Bio (bē'ō-bē'ō) River, in Chile, rises in the Andes and flows n.w. into the Pacific at Concepción; about 240 mi. long.

Biochemistry, chemistry of living matter and vital processes B-145-7

carbohydrates B-145

digestion D-90-2, diagrams D-90-1b

enzymes D-388-9, table D-389

fats and lipids B-145

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methods of analysis B-147: centri-

fuge and ultracentrifuge devices C-178, picture C-178

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proteins F-422, B-145

protoplasm F-422, B-145

radioactive isotopes in R-55

respiration R-117-18, B-146

vitamins V-494-8

Biodynes (biō'dins), substances resembling hormones that stimulate cell reproduction; discovered 1935-40 by George Spertl; used for burns.

Biogenesis, the theory that all living forms spring from a living parent organism. It is opposed to the theory of abiogenesis, or spontaneous generation, that life can come into being from nonliving matter.

Biography, a written account of a person's life; autobiography is the story of one's life written by himself

American literature A-226, 230, 230f-1

biographical directories R-88f

selected list R-88f

English literature E-378b

writing of W-314

Biological Survey, Bureau of, U. S. government, consolidated, 1940, with U. S. Bureau of Fisheries to form Fish and Wildlife Service. See in Index Fish and Wildlife Service

Biological warfare B-14, A-382

Biology, the science of life B-147-54, color picture B-149, Reference-Outline B-152-3. See also in Index Adaptation; Anatomy; Biochemistry; Biometry; Botany; Life; Physiology; Reproduction; Zoology; and chief subjects below

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plant life P-286-301, L-223-5, pictures P-293-300, 302, color pictures P-286-92

prehistoric life B-151

Bioluminescence, the emission of light by living organisms due to the slow oxidation of certain substances manufactured by them P-208

Biometry, the study of biological problems by mathematical and statistical methods B-154-5

Bion (biō'n) (2d century B.C.), Greek pastoral poet, younger contemporary and imitator of Theocritus; style graceful but over-sentimental; long descriptive epic 'The Dirge of Adonis' influenced Shelley's 'Adonais'.

Biotin (vitamin H) V-496, 498

Bi'tote, a black mica M-266, R-169

Bi'plane A-103

Wright brothers' first airplane W-309-10

Birch, Harvey, in novel by James Fenimore Cooper C-468

Birch, Reginald Bathurst (1856-1943), American artist, born London, England; moved to U.S. 1860; illustrated stories and poems, notably 'Little Lord Fauntleroy'.

Birch, a tree B-155, pictures B-155, T-180, 182, table W-186c

bark stripping, picture C-113

leaf, pictures B-155, T-183; dye from D-165

Birch-bark canoe B-214, B-155, C-114

making, pictures C-113, I-102

Birch family (Betulaceae), a family of trees and shrubs; includes alder, birch, hazelnut, and hornbeam.

Bird Day, observed by schools in at least 30 states of the U.S.; date usually designated each year by state governor; purpose, to teach appreciation and protection of birds.

Bird dogs D-110a-b

Birdhouses B-187-8, pictures B-187, 189

Birdie, in golf G-136

Bird lice, or biting lice, a group of insects of the order Mallophaga, family Philopteridae; each species lives on only one or a few closely related bird species; especially the slender pigeon louse (Columbicola columbae); P-78, color picture I-154b

'Bird-Lore'. See in Index 'Audubon Magazine'

Bird of paradise P-72, 75-6, color picture P-74

Bird-of-paradise flower. See in Index Strelitzia

Bird reservations B-196. See also in Index Birds, subhead protection

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E 168 See also *Index* Stories
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cockatoo P 93 91 P 183 184 color
pict re P 93 raven R 79
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B 157
vision B 167 nocturnal birds O 430
vocal organs B 171
water birds conserving B 193-4
pictures B 195 E 221
wings B 157 picture H 256 greatest
spread A 140 penguin P 120
young care of B 174
Birds Christmas Carol The story by
Kate Douglas Wiggin the heroine
is Carol Bird an invalid girl born
on Christmas Day
Birdseye, Clarence (born 1886) food
preservation expert and inventor
born Brooklyn N.Y. noted for per-
fecting quick freezing process for
foods and for improved method of
dehydrating foods
Birdseye, Claude Hale (1878-1941)
topographic eng near born Syria
cous N.Y. led expedition by boat
through Grand Canyon in 1923

Bird's eye maple or curly maple M 82
Bird's eye See *Index* U.S.A.
Bird's foot trefoil See *Index* Trefoil
Bird's nest sp. S 459
Birds of America by Audubon A 471
Birds of prey chiefly birds of orders
Falconiformes and S. 459
B 178 color picture B 181
condor C 431b 2 pict re C 432
eagle E 167 9 pict re E 167-9
hawk falcon and osprey H 291-3
pict re H 291 3
k e f 42
owl O 430 1 pict re O 430-1
shrike S 168 pict re S 168
Hir. spider S 345 pict re S 345
Bird Woman See *Index* Saca
Jawa
Birame (bird's) ancient ship S 150
pict re M 238/
Biret la cap w rn by Roman Catho i
c ergy iope wears white card na
red b shop purple others black
Birger (d. 95) Earl of Bj lbo
(d. 1766 regent of Sweden
1250-66) built Stockholm con
quered Finland
Birgitta Sankt See *Index* Dr dget
of Sweden
Birkenhead Frederick Edwin Smith
first earl (1871-1904) British
C. nurse i e statesman and law
yer attorney general 1912-19
Lord High Chancellor or 1919-20
secretary of sta e f r India 19 4-
24 wrote on po ti s law (Inter-
national Law and Famous Trials
of History)
Birkenhead England seaport and
shipbuilding center on the Mersey
opp site Liverpool pop 142 892
L 277 278 map B 325
Queensway Road Tunnel (Mersey
Tunnel) T 209 L 278
Bird's eye logrolling sport in which
two stand ng on oppo te ends of
floating log try to upset each other
by wa i ng or sp ining (roll ng) the
log with the feet also racing and
acrobatic cs on floating logs origi-
nated about 1940 as a lumber camp
sport a meet is also a role
Birmingham George A. pen name of
Cannon James Owen Hannay 1885-
1950) Irish clergyman and novel
ist (The Seeth ng Pot Spanish
Gold The Island of Mystery)
Birmingham (bir'm ng h m) A. a
ch of city of the state pop 326 037
B 198-7 A 116 maps A 126 U 253
pict re A 113 117
natural gas pipelines supply G 33
Birmingham (ber'm ng am) En-land
113 mi n w of London pop 1 112
B 197 maps B 325 inset B 324
Birmingham Mich industrial center
18 mi n w of Detroit pop 15 467
map I 467 M 227
Birmingham So then College Bir-
mingham Ala. college of liberal
arts and sciences resulting from a
merger of two Method st Univer-
sities in 1918-Southern Ala. 1855
founded at Greensboro Ala. 1855
and Birmingham College founded
at Birmingham Ala. 1895
Birney (Alfred) Earle (born 1904)
Canad an poet and educator born
Calgary Alberta (poetry David
Calgary and Poems Now Is Time
and The Strait of Anian) C 106a
Birney Alice McLellan (Mrs Theodore
W. Birney) (1858-1907) founder
of National Congress of Mothers
born Marietta Ga. P 86
Birney James Gillespie (1922-1957)
reformer born Danville Ky leader
of moderate abolitionists Liberty
party candidate for president 1940
and 1944 C 331
Birnie Island in Pacific See *Index*
Phoenix Islands

Birebidhan (bir d bi gan) or Bira
bdjan Jav sh autonomous reg n
of the U.S.S.R. on Amur R ver in
e Siberia pop about 150 000 cap
L-rb dzhun (pop 29 634) some
n ning hefly agriculture R 289
Birrell Augustino (1850-1933) Eng
lish essayist and pol itical leader
chief e r etary for Ire and 1907 16
individual and witty style called
birrelling (O the Dicta Men
Women and Books critical bio-
ographies of Charlotte Brontë Wil-
liam Hazlitt Collected Essays)
Bira Nimrud Iraq See *Index*
Bira
Birth of infant C 240
Birth ly v f fan ny men and women
lats B 56 9 See also table on
f l v pages
official b rthday of British sovereign
L 303
Birth ly stones color i ture J 348
Birth rate P 372 graph P 372
United States P 372 chart U 316
graph P 372
Birth set family or Arctostaphylos
(d rus to d k a s d) a family of
p anic and shrubs nat ve chiefly to
South Amer ca includ ng Dutch
man's pipe la can flower Virginia
snail eroot and wild g nter
Blaine (bis bl) Ariz copper mining
and smelting town in e of state
pop 3801 als gold silver and lead
mining maps A 353 U 282
Blaisy Bay of part of Atlantic Ocean
w of France and n of Spain n cps
E 416 419 picture F 161
Bliscayne (bis l d) Bay on e coast
of Florida M 211 map T 151 pic-
ture F 161
Blisce Jolin (d ed 1849) English
navigator d scovered Enderby
Land and Blisce Islands in Antarc-
tic in 1830 35
Blau t bread B 293 298
Blauit or Blisque (bl s) in pottery
mailing I 323
blisque (bis ling) P 400
used in making dolls D 122/ color
pict re D 122a
Bishop Claude Fuchet American
writer b rn France in Paris 1924
was head of L Heu e Joyeuse first
French public library devoted en-
tirely to children founded by Amer-
icans later in New York Public
Library (books for children Five
Chase Brothers' Austruts Pan-
cakes-Paris All Alone adut
books France Allve and All
Things Common)
Bishop Elizabeth (born 1911) poet
born Worcester Mass (North &
South)
Bishop Sir Henry Rowley (1786-
1855) Eng sh composer wrote
operas cantatas, and incidental
music to Shakespeare's dramas
best known for e es and songs
music for Home Sweet Home
ballad opera C 359
Bishop John Peale (1942-1944) au-
thor born Charles Town W Va
(The Undertakers Garland poetry
with Edmund Wilson Selected
Poems Many Thousands Gone
short stories Act of Darkness
novel)
Bishop from Greek episkopos over-
seer) title of highest ranking
clergy in certain branches of Chr
ian church functions in general
include the ord nation of priests
and lower clergy administration of
confirmation in Roman Catholic
church symbols are mit e jeweled
ring pastoral staff and throne
(cathedra) in cathedral church
cathedral seat of C 159
Church of England E 358

CALENDAR OF BIRTHDAYS*

January

- 1 (1484) Ulrich Zwingli
 1 (1735) Paul Revere
 1 (1745) Anthony (Mad Anthony) Wayne
 1 (1752) Betsy Ross
 1 (1834) Ludovic Halévy
 1 (1895) J. Edgar Hoover
 2 (1752) Philip Freneau
 2 (1873) Saint Theresa of Lisieux
 2 (1894) Artur Rodzinski
 3 (106 B.C.) Cicero
 3 (1793) Lucretia Mott
 4 (1783) Jakob Grimm
 5 (1779) Stephen Decatur
 5 (1779) Zebulon Montgomery Pike
 6 (1412) Joan of Arc
 6 (1811) Charles Sumner
 6 (1822) Heinrich Schliemann
 6 (1878) Carl Sandburg
 7 (1800) Millard Fillmore
 8 (1792) Lowell Mason
 9 (1859) Carrie Chapman Catt
 10 (1737) Ethan Allen
 11 (1757) Alexander Hamilton
 11 (1807) Ezra Cornell
 11 (1815) Sir John A. Macdonald
 11 (1842) William James
 11 (1856) Christian Sinding
 12 (1588) John Winthrop
 12 (1628) Charles Perrault
 12* (1729) Edmund Burke
 12* (1737) John Hancock
 12 (1746) Johann Heinrich Pestalozzi
 12 (1852) Joseph J. C. Joffre
 12 (1856) John Singer Sargent
 12 (1876) Jack London
 12 (1890) Mordchai W. Johnson
 13 (1834) Horatio Alger
 14 (1741) Benedict Arnold
 14 (1875) Albert Schweitzer
 14 (1882) Hendrik Willem Van Loon
 15 (1622†) Molière
 16 (1876) Robert W. Service
 17 (1504) Saint Pius V (pope)
 17 (1706) Benjamin Franklin
 17 (1869) Anton Chekhov
 17 (1863) David Lloyd George
 18 (1782) Daniel Webster
 18 (1882) A. A. Milne
 19 (1736) James Watt
 19 (1807) Robert E. Lee
 19 (1809) Edgar Allan Poe
 19 (1813) Sir Henry Bes-emer
 19 (1839) Paul Cézanne
 19 (1887) Alexander Woolcott
 20 (1806) Nathaniel Parker Willis
 20 (1876) Josef Hofmann
 20 (1891) Mischa Elman
 21 (1743) John Fitch
 21 (1813) John C. Frémont
 21 (1824) Thomas Jonathan (Stonewall) Jackson
 22 (1561) Francis Bacon
 22 (1729) Gotthold Ephraim Lessing
 22 (1778) André Marie Ampère
 22 (1848) George Gordon, Lord Byron
 22 (1849) Johan August Strindberg
 23 (1783) Stendhal
 24 (1712) Frederick II, the Great, of Prussia
 24 (1862) Edith Wharton
 24 (1865) Paul Wayland Bartlett
 25 (1627) Robert Boyle
 25 (1759) Robert Burns
 25 (1874) W. Somerset Maugham
 26 (1763) Jean B. J. Bernadotte
 26 (1831) Mary Mapes Dodge
 26 (1880) Douglas MacArthur
 26 (1884) Roy Chapman Andrews
 27 (1756) Wolfgang Amadeus Mozart
 27 (1832) Lewis Carroll
 27 (1850) Samuel Gompers
 27 (1859) William II of Germany
 27 (1885) Jerome Kern
 28 (1837) Henry VII of England
 28 (1822) Alexander Mackenzie
 28 (1833) Charles George (Chinese) Gordon
 28 (1856*) Artur Rubinstein
 29 (1688) Emanuel Swedenborg
 29 (1737) Thomas Paine

- 29 (1843) William McKinley
 29 (1866) Romain Rolland
 30 (1862) Walter Damrosch
 30 (1882) Franklin D. Roosevelt
 31 (1734) Robert Morris
 31 (1752) Gouverneur Morris
 31 (1797) Franz Schubert
 31 (1848) Nathan Straus
 31 (1881) Irving Langmuir
 31 (1885) Anna Pavlova

February

- 1 (1859) Victor Herbert
 1 (1882) Louis Stephen St. Laurent
 1 (1902) (James) Langston Hughes
 2 (1875) Fritz Kreisler
 2 (1901) Jascha Heifetz
 3 (1809) Felix Mendelssohn-Bartholdy
 3 (1811) Horace Greeley
 3 (1842) Sidney Lanier
 3 (1874) Gertrude Stein
 3 (1894) Norman Rockwell
 4 (1902) Charles A. Lindbergh
 5 (1826) Madame de Staël
 5 (1788) Sir Robert Peel
 5 (1837) Dwight L. Moody
 6 (1665) Anne, queen of England
 6 (1756) Aaron Burr
 6 (1833) James E. B. (Jeb) Stuart
 6 (1838) Sir Henry Irving
 6 (1895) Babe Ruth
 7 (1478) Sir Thomas More
 7 (1812) Charles Dickens
 7 (1874) Louis Agassiz Fuertes
 7 (1885) Sinclair Lewis
 8 (1819) John Ruskin
 8 (1820) William T. Sherman
 8 (1828) Jules Verne
 9 (1773) William Henry Harrison
 9 (1853) Sir Leander Starr Jameson
 10 (1775) Charles Lamb
 10 (1868) William Allen White
 11 (1847) Thomas A. Edison
 11* (1873) Feodor Chalapin
 12 (1663) Cotton Mather
 12 (1746) Thaddeus Kosciuszko
 12 (1791) Peter Cooper
 12 (1809) Charles Darwin
 12 (1809) Abraham Lincoln
 12 (1828) George Meredith
 12 (1880) John L. Lewis
 12 (1890) Omar Bradley
 13 (1754) Talleyrand
 13 (1892) Grant Wood
 14 (1847) Anna Howard Shaw
 15* (1584) Galileo
 15 (1710) Louis XV of France
 15 (1809) Cyrus Hall McCormick
 15 (1820) Susan B. Anthony
 15 (1845) Elihu Root
 15 (1874) Sir Ernest Shackleton
 15 (1882) John Barrymore
 16 (1838) Henry Adams
 16 (1898) Katharine Cornell
 17 (1766) Thomas Robert Malthus
 17 (1879) Dorothy Canfield Fisher
 17 (1881) Bess Streeter Aldrich
 18 (1516) Mary I of England
 18 (1745) Count Alessandro Volta
 18 (1795) George Peabody
 18 (1860) Anders Leonhard Zorn
 18* (1896) Dimitri Mitropoulos
 19 (1717) Nicolaus Copernicus
 19 (1717) David Garrick
 19 (1849) Adeline Patti
 19 (1859) Svante August Arrhenius
 19 (1865) Sven A. Hedin
 20 (1877) Mary Garden
 20 (1887) Vincent Massey
 21 (1801) John Henry, Cardinal Newman
 21 (1855) Alice Freeman Palmer
 21 (1907) Wystan Hugh Auden
 22 (1732) George Washington
 22 (1788) Arthur Schopenhauer
 22 (1810) Frédéric Chopin
 22 (1819) James Russell Lowell
 22 (1857) Robert, Lord Baden-Powell
 22 (1857) Heinrich Rudolph Hertz
 22 (1892) Edna St. Vincent Millay
 23 (1853) Samuel Pepys
 23 (1685) George Frederick Handel
 23 (1817) George F. Watts

- 24 (1500) Charles V, Holy Roman emperor
 24 (1786) Wilhelm Karl Grimm
 24 (1836) Winslow Homer
 24 (1885) Chester W. Nimitz
 25 (1778) José de San Martín
 25 (1841) Pierre Auguste Renoir
 25 (1866) Benedetto Croce
 25 (1873) Enrico Caruso
 25 (1890) Myra Hess
 26 (1802) Victor Hugo
 26 (1846) Buffalo Bill (William F. Cody)
 27 (1807) Henry Wadsworth Longfellow
 27 (1823) Ernest Renan
 27 (1848) Ellen Terry
 27 (1850) Henry E. Huntington
 27 (1863) Joaquín Sorolla y Bastida
 27 (1890) Charles Herbert Best
 27 (1902) John Steinbeck
 28 (1533) Montaigne
 28 (1865) Sir Wilfred Grenfell
 28 (1890) Vaslav Nijinsky
 29 (1792) Gioacchino Antonio Rossini

March

- 1 (1837) William Dean Howells
 1 (1848) Augustus Saint-Gaudens
 2 (1545) Sir Thomas Bodley
 2 (1769) De Witt Clinton
 2 (1793) Sam Houston
 2 (1824) Friedrich Smetana
 2 (1829) Carl Schurz
 2 (1876) Pius XII (pope)
 2 (1890) Paul De Kruif
 3 (1831) George Mortimer Pullman
 3 (1847) Alexander Graham Bell
 3 (1873) William Green
 3 (1895) Matthew B. Ridgway
 4 (1748) Casimir Pulaski
 4 (1756) Sir Henry Raeburn
 4 (1881) Thomas S. Stirling
 4 (1888) Knute Rockne
 5 (1512) Gerard Mercator
 5 (1853) Howard Pyle
 6 (1475) Michelangelo
 6 (1806) Elizabeth Barrett Browning
 6 (1831) Philip Henry Sheridan
 6 (1834) George Du Maurier
 6 (1872) Johan Bojer
 6 (1885) Ring W. Lardner
 7 (1802) Sir Edwin Henry Landseer
 7 (1841) William Rockhill Nelson
 7 (1849) Luther Burbank
 7 (1850) Thomas G. Masaryk
 7 (1875) Maurice Ravel
 8 (1841) Oliver Wendell Holmes (jurist)
 8 (1858) Ruggiero Leoncavallo
 8 (1888) Stuart Chase
 9 (1824) Leland Stanford
 10 (1452) Ferdinand II of Aragon
 10 (1867) Lillian D. Wald
 11 (1544) Torquato Tasso
 11 (1890) Vannoy Bush
 11 (1899) Frederick IX of Denmark
 12 (1655) George Berkeley
 12 (1795) William Lyon Mackenzie
 12 (1838) Sir William Henry Perkin
 12 (1858) Adolph S. Ochs
 12 (1863) Gabriele d'Annunzio
 13 (1733) Joseph Priestley
 13 (1872) Oswald Garrison Villard
 14 (1782) Thomas Hart Benton (senator)
 14 (1820) Victor Emmanuel II of Italy
 14 (1837) Charles Ammi Cutter
 14 (1834) Paul Ehrlich
 14 (1868) Maxim Gorky
 14 (1879) Albert Einstein
 15 (1767) Andrew Jackson
 15 (1858) Liberty Hyde Bailey
 15 (1874) William Chandler Bagley
 16 (1751) James Madison
 16 (1787) George Simon Ohm
 17 (1846) Kate Greenaway
 17 (1902) Bobby Jones
 18 (1782) John C. Calhoun
 18 (1837) Grover Cleveland
 18 (1844) Nicholas A. Rimsky-Korsakov
 18 (1858) Rudolf Diesel
 19 (1813) David Livingstone
 19 (1847) Albert P. Ryder
 19 (1860) William Jennings Bryan
 19 (1872) Sergei P. Diaghilev

*Birthdays commonly celebrated in the schools will be found on pages F-56-7.

†Date of baptism. According to the Old Style Calendar.

(Continued on the next page)

(Continued on the next page)

u = French u, German u, œ in du, thin, then, u = French u real (Jeu), -h = French /z/ in azure, x = German guttural ch

CALENDAR OF BIRTHDAYS*—Continued

- 13 (1865) William Butler Yeats
13 (1894) Mark Van Doren
14 (1811) Harriet Beecher Stowe
14 (1884) John McCormack
15 (1843) Edvard Grieg
15 (1861) Ernestine Schumann-Heink
15 (1887) Malvina Hoffman
16† (1903) Helen Traubel
17 (1882) Charles XII of Sweden
17 (1818) Charles Gounod
17 (1914) John Hersey
18† (1239) Edward I of England
18 (1854) Edward Wyllis Scripps
18 (1868) Nicholas Horthy
18 (1896) Philip Barry
19 (1866) James I of England
19 (1623) Blaise Pascal
19 (1903) Lou Gehrig
21 (1882) Rockwell Kent
22† (1805) Giuseppe Mazzini
23 (1875) Carl Milles
23 (1876) Irvin S. Cobb
23 (1894) Edward, Duke of Windsor
24 (1650) Duke of Marlborough
24 (1818) Henry Ward Beecher
24 (1880) Earl Kitchener of Khartum
24 (1895) Jack Dempsey
26 (1824) William Thomson, Lord Kelvin
26 (1854) Sir Robert Laird Borden
26 (1892) Pearl Buck
27 (1846) Charles Stewart Parnell
27 (1850) Lafcadio Hearn
27 (1872) Paul Laurence Dunbar
27 (1880) Helen Keller
28 (1491) Henry VIII of England
28† (1577) Peter Paul Rubens
28 (1703) John Wesley
28 (1712) Jean Jacques Rousseau
28 (1858) Otis Skinner
28 (1867) Luigi Pirandello
28 (1873) Alexis Carrel
29 (1855) George W. Goethals
29 (1861) William James Mayo
29 (1865) William Edgar Borah
30 (1817) Sir Joseph Dalton Hooker
- 16 (1821) Mary Baker Eddy
16 (1872) Roald Amundsen
16 (1877) Bela Schick
17 (1674) Isaac Watts
17 (1763) John Jacob Astor
18 (1811) William Makepeace Thackeray
19 (1834) Edgar H. G. Degas
19 (1865) Charles Horace Mayo
19 (1896) Archibald Joseph Cronin
20 (1304) Petrarch
21 (1898) Ernest Hemingway
22 (1892) Haile Selassie I of Ethiopia
22 (1898) Stephen Vincent Benét
23 (1834) Cardinal Gibbons
24 (1873) Simón Bolívar
24 (1802) Alexandre Dumas, the Elder
24 (1819) Josiah Gilbert Holland
24 (1835) Amelia Earhart
25 (1844) Thomas Eakins
25 (1848) Sir Arthur James Balfour
25 (1870) Maxfield Parrish
26 (1856) George Bernard Shaw
26 (1876) Ignacio Zuloaga
26 (1874) Serge Koussevitzky
27 (1824) Alexandre Dumas, the Younger
27 (1869) Booth Tarkington
29 (1877) Charles William Beebe
29 (1853) Benito Mussolini
29 (1887) Sigmund Romberg
31 (1863) Henry Ford
31 (1803) John Ericsson
- 1 (1744) Jean Baptiste de Lamarck
1 (1815) Richard Henry Dana, Jr.
1 (1819) Herman Melville
2 (1755) Pierre Charles L'Enfant
2 (1820) John Tyndall
3 (1872) Haakon VII of Norway
3 (1887) Rupert Brooke
3 (1900) Ernie Pyle
4 (1792) Percy Bysshe Shelley
4 (1839) Walter Pater
4 (1859) Knut Hamsun
5 (1850) Guy de Maupassant
5 (1889) Conrad Aiken
6 (1839) Alfred, Lord Tennyson
6 (1823) Lord Strathcona
7 (1924) Ralph Bunche
8 (1819) Charles Anderson Dana
8 (1834) Sara Teasdale
8 (1901) Ernest O. Lawrence
9 (1593) Izaak Walton
9 (1631) John Dryden
9 (1776) Amadeo Avogadro
10 (1810) Count di Cavour
10 (1874) Herbert Hoover
11 (1833) Robert G. Ingersoll
12 (1774) Robert Southey
12 (1859) Katharine Lee Bates
12 (1862) Julius Rosenwald
12 (1880) Christy Mathewson
12 (1882) George W. Bellows
14 (1860) Ernest Thompson Seton
14 (1867) John Galsworthy
15 (1769) Napoleon Bonaparte
15 (1771) Sir Walter Scott
15 (1785) Thomas De Quincey
15 (1879) Ethel Barrymore
15 (1853) Ivan Mestrovic
15 (1887) Edna Ferber
15 (1888) T. E. Lawrence
17 (1786) David Crockett
18 (1774) Meriwether Lewis
18 (1890) Francis Joseph I of Austria
19 (1856) John C. Danahy
19 (1870) Bernard Baruch
19 (1871) Orville Wright
19 (1878) Manuel Quezón
19 (1893) Alfred Lunt
19 (1902) Ogden Nash
20 (1778*) Bernardo O'Higgins
20 (1818) Emily Brontë
20 (1833) Benjamin Harrison
22 (1862) Claude Debussy
23 (1754) Louis XVI of France
23 (1853) Jonathan M. Wainwright
24 (1591*) Robert Herrick
24 (1769) Georges Cuvier
25 (1530) Ivan IV, the Terrible, of Russia
25 (1836) Bret Harte
26 (1743) Antoine Lavoisier
- 26 (1873) Lee De Forest
27 (1770) Georg Hegel
27 (1865) Charles G. Dawes
27 (1871) Theodore Dreiser
27 (1877) Lloyd C. Douglas
28 (1749) Johann Wolfgang von Goethe
28 (1828*) Count Leo Tolstoy
28 (1833) Sir Edward Burne-Jones
29 (1632) John Locke
29 (1809) Oliver Wendell Holmes (author)
29 (1862) Maurice Maeterlinck
30 (1871) Ernest, Lord Rutherford
30 (1901) John Gunther
31 (1811) Théophile Gautier
31 (1821) Hermann von Helmholtz
31 (1870) Maria Montessori
31 (1880) Wilhelmina, queen of the Netherlands
31 (1908) William Saroyan
- September**
- 1 (1795) James Gordon Bennett
1 (1877) Francis William Aston
2† (1850) Eugene Field
3 (1724) Guy Carleton
3 (1856) Louis H. Sullivan
4 (1892) Marcus Whitman
5 (1853) Cardinal Richelieu
5 (1791) Giacomo Meyerbeer
5 (1892) Joseph Szigeti
6 (1757) Marquis de Lafayette
6 (1766) John Dalton
6 (1805) Horatio Greenough
6 (1860) Jane Addams
7 (1533) Elizabeth I of England
7 (1930) Baudouin, king of Belgium
8 (1157) Richard I, the Lion-Hearted, of England
8 (1474) Ludovico Ariosto
8 (1841) Antonin Dvořák
8 (1889) Robert A. Taft
9 (1737) Luigi Galvani
10 (1885) Carl Van Doren
10 (1892) Arthur H. Compton
11 (1862) O. Henry
11 (1877) Sir James Hopwood Jeans
12 (1494) Francis I of France
12 (1880) H. L. Mencken
12 (1851) Walter Reed
13 (1860) John J. Pershing
13 (1874) Arnold Schönberg
13 (1876) Sherwood Anderson
14 (1735) Robert Raikes
14 (1763) Alexander von Humboldt
14 (1859) Hamlin Garland
14 (1867) Charles Dana Gibson
15 (1893) James Fenimore Cooper
15 (1857) William Howard Taft
15 (1876) Bruno Walter
15 (1889) Robert Benchley
16 (1838) Louis XIV of France
16 (1823) Francis Parkman
16 (1838) James J. Hill
16 (1880) Alfred Noyes
18 (1709) Samuel Johnson
18 (1819) Jean Foucault
20 (1878) Upton Sinclair
20 (1886) Elizabeth Kenny
21 (1452) Savonarola
21 (1645) Louis Joliet
21 (1756) John Loudon MacAdam
21 (1866) H. G. Wells
21 (1867) Henry L. Stimson
22 (1694) Earl of Chesterfield
22 (1791) Michael Faraday
23 (63 B.C.) Augustus, emperor of Rome
24 (1717*) Horace Walpole
24 (1755) John Marshall
24 (1884) Ismet Inönü
25 (1844) Sarah Bernhardt
26 (1870) Christian X of Denmark
26 (1888) T. S. Eliot
26 (1898) George Gershwin
26† (1906) Dmitri Shostakovich
27 (1722) Samuel Adams
27 (1840) Alfred Thayer Mahan
27 (1840) Thomas Nast
27 (1862) Louis Botha
28 (1839) Frances E. Willard
28 (1841) Georges Clemenceau
28 (1863) Frederick MacMonnies
29 (1725) Robert, Lord Clive

*Birthdays commonly celebrated in the schools will be found on pages F-56-7.

†Date of baptism.

According to the Old Style Calendar.

(Continued on the next page)

CALENDAR OF BIRTHDAYS*—Concluded

| | | |
|--|---|---|
| 29 (1758) Horatio Lord Nelson | 3 ^o (1500) Benvenuto Cellini | 5 (1782) Martin Van Buren |
| 29 (1901) Lorré Fermi | 3 (1794) William Cullen Bryant | 5 (1870) Christina Rossetti |
| | 3 (1873) Vilhjalmur Stefansson | 5 (1839) George Armstrong Custer |
| | 4 (1879) Will Rogers | 5 (1897) Josef Pilsudski |
| 1 (1781) James Lawrence | 4 (1857) Ida M. Tarbell | 5 (1901) Walt Disney |
| 1 (1904) Vladimir Horowitz | 6 (1834) John Philip Sousa | 6 (1732) Warren Hastings |
| 2 (1842) Richard III of England | 6 (1889) Ignace Jan Paderewski | 6 (1859) E. H. Sothern |
| 2 (1847) Paul von Hofenbergh | 7 (1887) Marie Curie | 6 (1867) Charles Martin Hall |
| 2 (1851) Ferdinand Foch | 7 (1878) Lise Meitner | 6 (1908) Jovce Kujner |
| 2 (1899) Mohandas Gandhi | 9 (1818) Ivan Turgenev | 6 (1887) Lynn Fontanne |
| 2 (1871) Cordell Hull | 9 (1841) Edward VII of England | 7 (1908) Giovanni Lorenzo Bernini |
| 3 (1900) George Bancroft | 10 (1851) Martin Luther | 7 (1901) Pietro Mascagni |
| 3 (1834) William Crawford Gorgas | 10 (1897) William Howard | 7 (1875) Wills C. Foster |
| 3 (1857) Eleonora Duse | 10 (1728) Oliver Goldsmith | 7 (1891) Rudolf Friml |
| 3 (1900) Thomas Wells | 10 (1753) Johann von Schöller | 8 (65 B.C.) Horace |
| 4 (1814) Jean François Millet | 10 (1801) Samuel Gridley Howe | 8 (1542) Mary Stuart, queen of Scots |
| 4 (1822) Rutherford B. Hayes | 10 (1879) Vachel Lindsay | 8 (1755) Eli Whitney |
| 4 (1858) Michael Pupin | 11 (1821) Fedor Dostoevsky | 8 (1812) Elysestjerne Hyttenaen |
| 4 (1881) Frederic Remington | 11 (1830) Thomas Bailey Aldrich | 8 (1895) Leo Julius Scheinin |
| 5 (1703) Jonathan Edwards | 11 (1872) Maude Adams | 9 (1594) Gustavus II Adolphus of Sweden |
| 5 (1713) Denis Diderot | 11 (1892) Gustavus VI Adolphus, of Sweden | 9 (1808) John Milton |
| 5 (1870) Chester Alan Arthur | 11 (1895) George S. Patton | 10 (1915) William Lloyd Garrison |
| 5 (1879) John Friskne | 11 (1854) Saint Augustine of Hippo | 10 (1822) Charles Francis Adams |
| 6 (1920) Jenny Lind | 12 (1871) James Clerk Maxwell | 10 (1900) Emily Dickinson |
| 6 (1840) George Westinghouse | 13 (1913) Edwin Booth | 10 (1837) Edward Eschmeyer |
| 7 (1872) William Laud | 13 (1880) Robert Louis Stevenson | 10 (1851) Melvil Dewey |
| 7 (1876) Louis Pannetier | 14 (1765) Robert Fulton | 11 (1819) Hector Berlioz |
| 7 (1849) James Whitcomb Riley | 14 (1840) Claude Monet | 11 (1841) Robert Koch |
| 7 (1886) Martha McChesney Berry | 14 (1863) Leo Hendrik Baekeland | 12 (1743) John Jay |
| 7 (1885) Niels Bohr | 14 (1859) Jaschahai Nehru | 12 (1921) Gustave Flaubert |
| 8 (1838) John Hay | 14 (1801) Sir Frederick Banting | 13 (1707) Hermann Heine |
| 8 (1900) Eddie Rickenbacker | 14 (1897) John Stuart Curry | 13 (1835) Phillips Brooks |
| 9 (1847) Cervantes | 14 (1945) Prince Charles of Great Britain | 14 (1568) Techo Brabe |
| 9 (1874) Charles Camille Saint-Saëns | 15 (1705) William Pitt, Earl of Chatham | 14 (1753) Henry IV of France |
| 9 (1867) Edward William Bok | 15 (1738) Sir William Herschel | 14 (1858) George VI of England |
| 9 (1904) Camille Bradford | 15 (1862) Gerhart Hauptmann | 15 (37) Nero |
| 10 (1864) Jean Watteau | 15 (1831) Franklin P. Adams | 15 (1888) Maxwell Anderson |
| 10 (1731) Henry Cavendish | 15 (1901) Franz Rommel | 16 (1770) Ludwig van Beethoven |
| 10 (1738) Benjamin West | 16 (1849) George S. Kaufman | 16 (1779) Jane Austen |
| 10 (1913) Giuseppe Verdi | 17 (1879) Grace Abbott | 16 (1885) George Santayana |
| 10 (1827) Paul Kruger | 17 (1857) Bernard Lee Montgomery | 16 (1909) Noel Coward |
| 10 (1871) Fredrik Nansen | 17 (1889) Louis Daguerre | 17 (1493) Paracelsus |
| 10 (1909) Lin Yü-tung | 18 (1876) Sir William S. Gilbert | 17 (1778) Sir Humphry Davy |
| 10 (1900) Helen Hayes | 18 (1896) Eugene O'Sullivan | 17 (1797) Joseph Henry |
| 11 (1884) Eleanor Roosevelt | 19 (1901) George Horace Gallup | 17 (1907) John Greenleaf Whittier |
| 12 (1775) Iyanan Beecher | 19 (1830) Charles I of England | 17 (1874) William Lyon Mackenzie King |
| 12 (1821) Rudolf Virchow | 19 (1782) George Rogers Clark | 18 (1788) Carl Maria von Weber |
| 12 (1844) William Penn | 19 (1770) Pärthel Thorvaldson | 18 (1801) Sir Joseph John Thomson |
| 12 (1942) James H. Vane | 19 (1905) Ferdinand de Lesseps | 18 (1891) Edward A. MacDonnell |
| 14 (1898) Katherine Mansfield | 19 (1871) James A. Garfield | 19 (1814) Edwin S. Stanton |
| 14 (1890) Dwight D. Eisenhower | 20 (1841) Sir Wilfrid Laurier | 19 (1881) Albert Abraham Michelson |
| 15 (70 B.C.) Vergil | 20 (1858) Selma Lagerlöf | 19 (1905) Minnie Maddalen Fiske |
| 15 (1844) Friedrich Wilhelm Nietzsche | 20 (1871) William Heard Kilpatrick | 19 (1884) Fritz Premer |
| 16 (1758) Noah Webster | 21 (1894) Voltaire | 20 (1868) Harvey S. Firestone |
| 16 (1898) Eugene O'Neill | 22 (1643) Pierre de La Salle | 20 (1914) Robert Gordon Menzies |
| 17 (1760) Claude Henri, Comte de Saint-Simon | 22 (1819) George Eliot | 21 (1903) Jean Baptiste Racine |
| 18 (1859) Henri Bergson | 22 (1861) Cyrus Edwin Dallin | 21 (1904) Benjamin Disraeli |
| 18 (1878) James Truslow Adams | 22 (1869) André Gide | 21 (1972) Albert Pisoni Terhune |
| 19 (1784) Leigh Hunt | 23 (1794) Franklin Pierce | 21 (1970) Joseph Stalin |
| 20 (1812) Sir Christopher Wren | 23 (1862) Sir Gilbert Parker | 22 (1860) James Oglethorpe |
| 20 (1852) John Dewey | 24 (1713) Father Junipero Serra | 22 (1889) Edwin Arlington Robinson |
| 21 (1772) Samuel Taylor Coleridge | 24 (1713) Laurence Sterne | 23 (1845) Deems Taylor |
| 21 (1833) Alfred Nobel | 24 (1784) Zachary Taylor | 23 (1713) Sir Richard Arkwright |
| 21 (1891) Ted Shawn | 25 (1823) Lope de Vega | 23 (1777) Alexander I of Russia |
| 22 (1811) Franz Liszt | 25 (1815) Andrew Carnegie | 23 (1904) Charles Augustus Sainte Beuve |
| 22 (1813) Stephen Moulton Babcock | 27 (1914) Joe Di Maggio | 23 (1895) Joseph Smith |
| 23 (1844) Robert Bridges | 27 (1874) Charles A. Beard | 23 (1825) Camille Maek |
| 23 (1844) Louis Riel | 28 (1757) William Blake | 24 (1891) Saint Ignace of Loyola |
| 24 (1812) Anthony van Leeuwenhoek | 28 (1829) Anton Rubinstein | 24 (1849) Christopher (Kit) Carson |
| 24 (1900) Thomas Babington Macaulay | 28 (1835) Tao tai | 24 (1822) Mathew (Grove) Perry |
| 24 (1825) Johann Strauss the Younger | 28 (1895) Joe's Hogan | 24 (3 B.C.) T. Je-u Chai |
| 24 (1838) George Buel | 29 (1877) John Harvard | 25 (1842) Sir Isaac Newton |
| 25 (1891) Pablo Picasso | 29 (1871) Gaetano Donizetti | 25 (1821) Clara Barton |
| 25 (1888) Richard Evelyn Byrd | 29 (1873) Louisa May Alcott | 25 (1885) Charles Gooden |
| 26 (1900) Helmut Karl Count von Moltke | 30 (1854) Sir Philip Sidney | 25 (1837) George Dewey |
| 27 (1782) Niccolò Paganini | 30 (1824) John Pung | 27 (1871) Johann Kepler |
| 27 (1858) Theodor Roosevelt | 30 (1857) Jonathan Swift | 27 (1823) Louis Pasteur |
| 29 (1740) James Boswell | 30 (1819) Cyrus West Field | 28 (1806) Woodrow Wilson |
| 29 (1795) John Keats | 30 (1815) Mark Twain | 28 (1800) Charles Gooden |
| 29 (1735) John Adams | 30 (1874) Winston (I. S.) Churchill | 29 (1875) Andrew Johnson |
| 30 (1751) Richard Brinsley Sheridan | | 29 (1891) William Gladstone |
| 31 (1829) Jan Vermeer | | 29 (1876) Pabst Caele |
| 31 (1907) Juliette Gordon Low | | 29 (1863) Rudyard Kipling |
| 31 (1866) Chang Kai-shek | | 29 (1887) Simon Gumpert |
| | | 30 (1801) Stephen Butler Leacock |
| | | 31 (1817) Mucilio |
| | | 31 (1715) Charles Lord Cornwallis |
| | | 31 (1869) Henri Matisse |
| | | 31 (1897) George C. Marshall |
| | | 31 (1904) Nathan Milstein |

*Birthdays commonly celebrated in the schools will be found on pages F-54-7
 †Date of baptism

According to the Old Style Calendar

u = French u, German u, gem. jo, thin, then, u = French nasal (Jean), sh = French f (s in azure), x = German guttural ch

- investiture conflict: Henry IV of Germany H-334-5, G-214; William II of England W-138
 medieval church C-302
 member of Parliament P-87
Bishop College, at Marshall, Tex.; Baptist; started 1881; liberal arts; graduate school in education
- Bishop's University**, Lennoxville Quebec, Canada; incorporated 1843; arts and sciences, divinity.
- Bishop's miter shell**, or episcopal miter shell (*Mitra episcopalis*), mollusk shell, color picture S-139
- Bis'kra**, Algeria. winter resort and important military post in fertile oasis 120 mi. s.w. of Constantine; pop. 36,347; maps A-167, A-46
- Bismarck**, Otto von (1815-98). German soldier and statesman B-197-8, G-97, picture B-197
 Franco-Prussian War F-277-8
 minister under William I W-135
 statue, picture G-100
 William II dismisses W-136
- Bismarck**, N. D., state capital, on Missouri River; pop. 18,640; B-198, maps N-288, U-252
 Capitol, State, picture N-291
 Lewis and Clark near site L-176
- Bismarck Archipelago**, formerly called New Britain Archipelago, group of islands n.e. of New Guinea consisting of New Britain (formerly New Pomerania), New Ireland (formerly New Mecklenburg), Lavongai (New Hanover), Admiralty Islands, and chain of lesser islands; area 19,200 sq. mi.; pop. 133,465; a German protectorate 1885-1919; N-143, maps E-203, P-16
- Bismarck Sea**, battle of W-262
- Bismuth** (*biz'müth*), a metallic chemical element B-198, chart R-54b, tables P-151, C-214
 alloys for low-temperature melting A-173
 compounds, source of radium and polonium R-56
 electrochemical activity E-315
 end-product of radioactivity R-54b
- Bl'son**, or American buffalo B-199-201, pictures B-199-200, color picture N-261
 Buffalo Bill B-342
 calf, picture B-200
 cattalo B-200, C-116
 fossils, New Mexico I-108c-f
 hunting I-103, 104-104a, picture I-90
 migration B-200, map M-241
- Bispham** (*bis'fām*), David Scull (1857-1921), operatic baritone, born Philadelphia, Pa.; as concert singer one of first to use English translations of German songs.
- Bisque**. See in Index Biscuit, in pottery making
- Bissau** (*bē'sou'*), Portuguese *Bissão* (*bē'sou'*), capital and chief port of Portuguese Guinea; pop. 6000; map A-46
- "Bit"**, popular name for a real, an old Spanish coin, worth about 12½ cents; hence, "2 bits," "4 bits," and "6 bits" (25, 50, and 75 cents); picture M-338
- Bite**, of dog, cat, and insect
 first aid F-97, 98
- Bithynia** (*bi-thin'i-g*), ancient country in Asia Minor, situated on Black Sea, map P-156
- Biting lice**. See in Index Bird lice
- Bitlis** (*bif-lis'*), trade center in Asiatic Turkey, 120 mi. s.e. of Erzurum.
- Bitolf** (*bē-tōl'*), or Bitola, Yugoslavia, also Monastir, town 85 mi. n.w. of Salonika; pop. 37,732; formerly important Turkish garrison; taken by Serbia 1912; maps B-23, E-417
- Bitter**, Karl (1867-1915), American sculptor, born Vienna, Austria; to U. S. 1889; versatile and skilled (huge relief in Pennsylvania Railroad Station, Philadelphia; bronze doors for Trinity Church, New York City; portrait statues).
- Bitter almonds** A-175
 oil, from benzene C-371
- Bitter ash**. See in Index Quassia
- Bitter chocolate**, or dark chocolate C-289
- Bittern**, a marsh bird, also called thunder pumper or stake driver B-201, pictures B-201, B-174, 177
 protective coloration, picture B-177
- Bitter nut** (*Illicoria minima*), a species of hickory similar to the pinut; thin-shelled nuts extremely bitter; wood hard and strong
- Bitterroot**, North American plant (*Lewisia rediviva*) with a bitter, tough edible root sometimes used as food by the Indians; leaves grow in clusters from the root about a fleshy stalk bearing a single rose-colored or white flower
 state flower of Montana, color picture S-384a
- Bitterroot Mountains**, range of Rocky Mts. along boundary between Idaho and Montana, maps I-14, 20-1, U-286, M-367
- Bitterroot River**, Mont., flows north 110 mi near w. border to join Clark Fork River near Missoula, maps M-374, 367
- Bitter sage** S-14
- Bittersweet**, a vine B-201
 nightshade B-201, picture P-339
- Bitu**. See in Index Nautical terms, table
- Bitu'men**, any of several substances formed from organic matter by heat and pressure within the earth
 asphalt A-423-4
- Bitu'minous coal**, soft coal C-363, 367.
 See also in Index Coal
- Bituminous Coal Act of 1937**, U. S. C-369-70
- Bituminous rock**, rock asphalt A-424
- Bit'valve**, mollusk M-333-4, S-139a-b.
 See also in Index Clam; Mussel; Oysters; Scallop; Tereido
- Biwa** (*bē-wā*) Lake, a lake of s. Japan having an area of 180 sq. mi.; situated in Honshu, in region rich in ancient legends; J-296
- Bizerte** (*bē-zēr't*), or Bizerta (*bī-zūr'tā*), seaport in Tunisia, n. Africa; pop. 39,327; important naval base; maps A-167, A-46
- Bizet** (*bē-zē'*), Georges (1838-75), French composer B-201-2, picture B-202
 "Carmen", story O-389-90, B-202
- Bizonia**, popular name given (upon merger in 1947) to the British and American zones in Germany, and to the economic administration of the zones; name changed to Trizonia Aug. 1948 when the French zone joined the merger.
- Bjerknes** (*byēr'knes*), Vilhelm (*vī'l'hēlm*) (1862-1951), Norwegian physicist; professor and researcher chiefly at University of Oslo and Geophysics Institute at Bergen; with his son Jakob (born 1897), developed method of weather forecasting by air mass analysis; W-81
- Bjoerling** (*byūr'ling*), Jussi (born 1911), Swedish operatic and concert tenor; toured U. S. at 10 as member of father's Bjoerling Male Quartet; studied, Stockholm Royal Opera; to U. S. in concert 1937; Metropolitan Opera debut 1938.
- Björkman** (*byūr'kman*), Edwin (August) (1866-1951), American critic, born Stockholm, Sweden; came to U. S. 1891; influential in introducing Scandinavian literature to Americans; translated Björnson, Strindberg, Schnitzler ('Gleams: A Fragmentary Interpretation of Man and His World'; 'Voices of Tomorrow'; 'Gates of Life', novel).
- Björnson**, Björnstjerne (*byūr'n'sōn*, *byūr'nst'jēr-nā*) (1832-1910), Norwegian poet, playwright, and novelist B-202
- Björnsson**, Sveinn (*svāt'n byūr'n-sōn*) (1881-1952), Icelandic statesman, born Reykjavik; minister to Denmark 1920-41; elected regent of Icelandic government 1941; first president Iceland republic 1944-52.
- Blache**, Paul Marie Joseph Vidal de La. See in Index Vidal de La Blache, Paul Marie Joseph
- Black**, Davidson (1884-1934), Canadian anatomist M-70
- Black**, Greene Vardiman (1836-1915), dentist, born near Winchester, Ill.; designed one of first cord dental machines 1871; established modern method of preparing cavities for fillings; devised durable amalgam fillings; designed scores of "cutting instruments"; professor Northwestern University Dental School 1891-1915 ('Dental Anatomy' and 'Operative Dentistry'); known as "father of modern dentistry".
- Black**, Hugh (1866-1953), Scottish-American clergyman and writer, born Rothesay, Scotland; professor practical theology, Union Theological Seminary, New York City ('The Dream of Youth'; 'Friendship'; 'Culture and Restraint').
- Black**, Hugo La Fayette (born 1886), jurist, born Harlan, Ala.; U.S. senator 1927-39; appointed associate justice U.S. Supreme Court 1937 by F. D. Roosevelt.
- Black**, Joseph (1728-99), Scottish chemist and physicist, discoverer of carbon dioxide; defined latent and specific heat
 phlogiston theory L-138-9
- Black**, William (1841-98), Scottish novelist ('Strange Adventures of a Phaeton'; 'A Princess of Thule').
- Black**, in color C-392, 394
 color printing, color picture C-399
 paints P-41
 produces shade in color C-394, color chart C-393
- Black abalone** (*Haliotis cracherodii*), snail
 shell, color picture S-139b
- Black alder**, a tree (*Alnus glutinosa*) of the birch family; has oval, saw-toothed leaves and small conelike fruit; native to Eurasia.
- Black and tan**, toy. See in Index Toy Manchester terrier
- Black and tan** coonhound D-110b, table D-118a
- Black and Tans**, nickname of Royal Irish Constabulary, formerly the military police of Ireland in Irish rebellion I-230b
- Black and tan setter**, or Gordon setter, color picture D-113, table D-118
- Black and white warbler** W-7
- Black angel**, an American food fish (*Pomacanthus arcuatus*) from 15 to 24 inches long; the young are black, crossed by yellow bands, which disappear later.
- Black ash**, a chemical mixture S-226
- Black ash**, tree (*Fraxinus nigra*) of olive family; grows to 75 ft.; leaves, to 5 in. long, have 7 to 11 leaflets. Wood dark brown, with a fine grain in heartwood; sapwood white; sometimes called brown ash, hoop ash, basket ash, swamp ash, water ash; A-401, table W-186c
- Black-backed gull** G-231
 "Blackball" B-36
- Black bass** B-77
- Black bear** B-86 pictures N-38b, E-86
- Blackbeard**, name given to Edward

Key: cape, at, fār, fāst, what, fall; mē, yēt, fērn, there; ice, bit; rōw, wōn, fōr, nōt, do; cūre, būt, ryde, full, bārn; out;

- Teach Anglo American pirate (died 1718) F 272
- Black Beauty novel See in Index
- Black-bellied plover F 321
- Black belt in Alabama A 113
- Blackberry B 202 color picture F 311
- Black-billed cuckoo C 529
- Black birch B 155
- Blackbird B 20-3 picture in B 202-3 length of life average pictograph A 249
- Black-bird B 203 picture B 202
- Red-winged B 202-3 picture B 202 color picture B 193 egg color picture B 202-3, hatching period B 174
- rusty B 176
- Black-bird distinguished from B 384
- Blackbirding in history of slavery the practice once prevalent in western Pacific regions of luring island natives aboard a ship kidnapping them and transporting them to forced labor in distant plantations. Sometimes the kidnapped people were paid nominal wages and were permitted to return home later sometimes they were sold into outright slavery. Some have been engaged in this business were called blackbirders. Entire islands were depopulated by them
- Black bread made from rye F 300
- Blackbuck or Indian antelope picture A 263
- Blackburn England cotton manufacturing city in Lancashire 24 n. w. of Manchester pop 111,217 was probably birthplace of James Hargreaves map B 325
- Blackburn College at Carlinville Ill chartered 1857 arts and sciences students pay fees by cash and work
- Black Butte in Bad Lands of s. w. D. highest point in state 3468 ft. map B 528
- Black Canyon of the Gunnison National Monument in Colorado N 30 maps C 408 N 18
- Black cherry wild (Prunus serotina) large tree with black bitter aromatic bark oblong leaves small fruit, purple black bitter ripening in late summer leaves flowers and seeds are poisonous containing the glucoside amygdalin from which hydrocyanic acid is formed grown from Nova Scotia Canada to Dakota s. to Florida and Texas C 233-4
- Black Codes in U. S. laws passed in South following Civil War R 856
- Black cottonwood or western balsam poplar tree (Populus trichocarpa) of willow family native from Alaska to California Grows 40 ft. to 180 ft. Leaves to 5 in. long w. thick or rusty on underside. Lives to 100 yrs. Wood is grayish white used chiefly for boxes and sold as cottonwood
- Black Country coal mining and manufacturing district in Midlands of England between Birmingham and Wolverhampton B 350 354
- Black crapple See in Index Crapple
- Black Crook early theater spectacle B 11
- Black Current C 530
- Black Current See in Index Japan Current
- Black Death B 203 See also in Index Bubonic plague
- effect on English agriculture A 71
- Hundred Years War interrupted by H 446
- Black duck or black mallard a surface feeding duck (Anas rubripes) D 150 picture D 161
- Black Eagle, Order of the highest order of chivalry in Prussia founded 1761 by Frederick I. men
- bership restricted to royalty and high officers of state only members of Order of the Red Eagle were eligible abolished 1919
- Blackett Patrick Maynard Stuart (born 1887) British physicist Langworthy Professor of Physics Manchester University since 1937 adviser to Britain on atomic energy in World War II received Nobel prize in physics 1948 for improvements of Wilson cloud chamber and for cosmic ray discoveries (Pear War and the Bomb)
- Black-eyed bean B 84
- Black-eyed Susan or yellow daisy D 5 color picture F 176
- starting flower of Maryland color picture F 176
- Black-eyed Susan vine See in Index Thunbergia
- Blackfoot or Blackfoot Indian tribe that lives in Montana and Alberta Canada map I 108 f. of forces I 1948 108a C 463 table I 107
- Blackfoot Sioux a tribe of the Teton Sioux living chiefly in South Dakota some in North Dakota distinct from a gonquian Blackfoot
- Black fellows of Australia A 480 picture A 481
- Black-burner B 249 pictures A 481 B 249
- Blackish Alaska a mudfish M 445
- Black fly biting fly of the family Simuliidae also called buffalo gnat and turkey gnat larvae live in swift streams
- Blackfoot Idaho city 46 mi. s. w. of Idaho Falls pop 5180 farming livestock dairying map I 21
- Black footed albatross A 140 pictures A 140
- Black footed ferret W 77
- Blackfoot Indians See in Index Blackfoot
- Black Forest German Schwarzwald region in s. w. Germany B 202-4 map G 85
- Black fox F 253
- Black Friars or Dominicans M 350 Inquisition I 151
- Blackfriars Theater 16th-century playhouse in London T 122 S 170
- Black Friday* panic See in Index Fick James Gould Jay
- Black frost F 303
- Black gum tree (Nyssa sylvatica) of the tupelo family native from Maine to Florida and Texas Rounded narrow crown deeply fissured bark branches drooping at ends. Leaves oval to 4 in. long green on upper surface brilliant red and purple in fall. Fruit oval dark blue small 1 to 3 in. cluster. Sometimes called pepperidge sour gum tupelo and black tupelo G 232 pictures T 122 182-3
- Black hawk a tall shrub or small tree (Viturnum prunifolium) of the honeysuckle family with stout spreading branches flowers white fruit a small sweet blue black oval drupe an ornamental shrub
- Black Hawk (1767-1839) Sauk Indian chief warred against Ojibwa and Cherokee Indians organized other tribes to attack Black Hawk War his autobiography dictated to an interpreter is an American classic his statue at Oregon Ill I 110b, I 221
- Black Hawk War I 110b Jefferson Davis D-22 Lincoln L 247 Taylor T 27
- Blackhead in skin S 193
- Black-headed grosbeak G 219, color picture B 184
- Blackheath open common in s. London England scene of many historic gatherings rallying place of Wat Tyler and Cade
- Black hellebore See in Index Christmas rose
- Black helmet shell S 1395
- Black Hills in South Dakota and Wyoming gold led a river named for dense pine forests Harney Peak 7422 ft. S 295 maps S 296 302 U 290 296 W 316 picture U 292
- Devils Tower National Monument N 33 map N 18 picture W 321 minerals S 296 305
- Mount Pishum Re Memorial A S 295 site picture S 306 S 73
- Needles pict re S 305
- Wind Cave National Park N 38c map N 18
- Black Hills Teachers College at Spearhead S D state control opened 1885 arts and sciences edu at on
- Black Hole of Calcutta C 21
- Blackie John Stuart (1809-84) Scottish philologist professor at Marischal College Aberdeen and at Edinburgh University wrote on philology and moral literary subjects and composed verse (Life of Burns translations of Faust dramas of Aeschylus The Mad)
- Blacking a preparation for polishing black shoes harness leathers etc usually contains lampblack sugar grease and calcium sulfate
- Blackjack oak tree (Quercus marilandica) of beech family native from New York to Nebraska and southward Grows to 30 ft. leaves to 8 in. long broad at tip with shallow lobes and white on underside. Scales on cup holding acorn curly backward
- Blackjack pine See in Index Lodgepole pine
- Black Kettle (1803?-84) Cheyenne Indian chief, offered friendship to whites who betrayed him he was killed at Sand Creek Colorado attacked by militia he led in massacre by Custer's forces in Washita Valley near Fort Cobb
- Black Kishka or Kara Kishka so called from color of the tents Mongolian people inhabiting high lands of central Asia
- Black lead See in Index Graph to Blackleg disease of cattle
- vaccinate against picture C 154
- Black letter style of type B 235
- Black light (photography) I 140
- super-scope pict re A 385
- Black line engraving C 380
- Blacklist in labor L 70c
- Black locust a tree L-294
- seedings prevent erosion pictures U 317
- weight of wood H 355
- Black maple A 38
- Black maple a sugar maple M 82, table W 186c
- Black market an illegal market where rationed or forbidden goods are bought and sold at high profits particularly in wartime
- Black marten Fisher or pekan M 104
- Black marten for S 193
- Black Monks See in Index Bene dictines
- Blackmore Richard Doddridge (1825-1900) English novelist, born Longworth Berkshire practiced law until health failed famed for romantic novel Lorna Doone a classic
- Black Mountain College near Black Mountain NC founded 1933 courses in arts and sciences comparable to usual collegiate work, but no degrees granted progressive and experimental emphasis community living individual responsibility
- Black French u. gem go (thin then, u. gem French nasal (See I)) - French f (s in azure) - G. roman natural ea

- Black Mountains**, spur of the Blue Ridge Mountains of S. Appalachians A-276
- Black mulberry** M-445
- Black-nosed dace**, or striped dace D-1
- Black oak**, tree (*Quercus velutina*) of beech family; leaves have 5 to 7 lobes; acorn in scaly cup, bark thick, nearly black: *table* W-186c
- Black opal** J-350
- Blackout**. See in *Index* Aviation, *table* of terms
- Black pepper** P-143, *picture* S-341
- Blackpoll warbler** M-243
- Blackpool**, England, watering place on Irish Sea, 30 mi. n. of Liverpool; pop. 147,131: *map* B-325
- Black powder** G-232-3, A-236a
- bullet**, *picture* A-236a
- Black Prince** H-445, 446. See also in *Index* Edward, Prince of Wales
- Black race**. See in *Index* Negroid race
- Black raspberry** R-76
- Black rat** R-77
- Black Republicans**, in U.S. history C-332
- Black River**, N. Y., rises in e.-central part of state and flows n.w. through Watertown into Lake Ontario; about 200 mi.; furnishes water power to town and surrounding villages: *maps* N-196, 205
- Black River**, Wis., tributary of Mississippi River; about 200 mi. long: *maps* W-166, 172-3
- Black Rock Desert**, in n.w. Nevada, *maps* N-126, 132
- Black Sea**, between s.e. Europe and Asia Minor B-204, *maps* B-204, E-417, 419, A-411. See also in *Index* Ocean, *table*
- Russian ports** B-204: canals connect with Volga V-523
- Black Sea wheat**, in U. S. A-63
- "Blackshirts"**, Fascists in Italy F-44, I-274, *picture* I-273
- Blacksmithing** B-204a, *picture* B-204a
- welding** W-90, B-204a
- Blacksnake** S-208
- Black spotted trout** T-193
- Black spruce** S-358
- Black stem rust** R-297
- Blackstone**, Sir William (1723-80), English jurist B-204b, *picture* B-204b
- Black Stone**, a Mohammedan fetish in the Kaaba shrine, Mecca, Arabia M-157
- Blackstone Canal**, between Providence, R.I., and Worcester, Mass.; opened 1828: *map* C-108
- Blackstone River**, rises in Massachusetts, crosses n.e. Rhode Island, and enters Providence River near Providence; length 50 mi.; called Seekonk in its lower course: *map* R-141
- Blackstrap molasses**, a low grade sugar-cane molasses from which most of the sugar has been extracted; also a by-product of raw sugar refining: S-444
- Industrial alcohol**, source of A-145, S-446
- Black swallowtail butterfly** metamorphosis, *picture* B-367b
- Black swan** S-460
- Black-tailed deer** D-44
- Black tea** T-30-2
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- Black tern** G-231, *picture* G-230
- Blackthorn**. See in *Index* Sloe
- Black-throated blue warbler**, *picture* W-7
- Black-throated bunting** B-353
- Black-throated green warbler**, *color picture* B-162
- Black tupelo**. See in *Index* Black gum
- Black vulture**, also called black buzzard V-524
- Black walnut** W-5-6, *picture* W-5, *table* W-186c
- Black Warrior River**, in w.-central Ala.; flows s.w. into Tombigbee River; navigable from Demopolis to Tuscaloosa: A-118, *maps* A-114, 126-7
- Blackwater River**, Ireland, chiefly in Cork county; flows e. and s. 100 mi. to Atlantic at Youghal Bay: *map* B-325
- Blackwell**, Alice Stone (1857-1950), journalist, born East Orange, N.J.; editor of *Woman's Journal* 1893-1917
- suffrage work** W-184
- Blackwell**, Elizabeth (1821-1910), first woman doctor of medicine in the United States B-204b, *picture* B-204b
- Blackwell**, Emily (1826-1910), American doctor of medicine, sister of Elizabeth Blackwell B-204b
- Blackwells Island**, N. Y. See in *Index* Welfare Island
- Black widow spider** S-346-7, *picture* S-347
- Black willow** W-142, *picture* W-143
- Blackwood**, Algernon (1869-1951), British novelist; especially successful in tales of fantasy and horror; polished style ('The Empty House'; 'The Centaur'; 'A Prisoner in Fairyland')
- Blackwood**, Frederick Temple. See in *Index* Dufferin and Ava, marquess of Blackwood, an acacia A-5
- Black work**, or niello (ni-cl'ò), in decorating metals E-386
- Bladder**, urinary K-39, *color pictures* P-242-3
- Bladder**, gall L-277, *color pictures* P-241-2
- Bladderwort**, an insect-eating plant, *picture* P-295
- Bladensburg**, Md., town 6 mi. e. of Washington, D.C.; pop. 2899; U. S. troops defeated by British August, 1814; once noted dueling ground: *map*, inset M-116
- Blaine**, James Gillespie (1830-93), American statesman B-205, *picture* H-276
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- home** in Augusta, Me. A-472a
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- peace efforts** P-101, H-276
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- Blair**, Andrew George (1844-1907), Canadian statesman, born Fredericton, New Brunswick, Canada; prime minister of New Brunswick 1883-96; minister of railways and canals for Canada 1896-1903.
- Blair**, Eric. See in *Index* Orwell, George
- Blair**, Francis Preston (1791-1876), American journalist, friend of Jackson and Van Buren, active supporter of Abraham Lincoln; father of Francis P., Jr., and Montgomery Blair; aided Union cause during Civil War.
- Blair**, Francis Preston, Jr. (1821-75), American journalist and Army officer prominent in Missouri politics; helped save state to Union; major general Union army; U. S. senator 1871-73. See also in *Index* Statuary Hall (Missouri) *table*
- Blair**, John (1732-1800), jurist, born Williamsburg, Va.; member of Federal Constitutional Convention, and one of seven Virginians to sign U. S. Constitution; associate justice U. S. Supreme Court 1789-96
- Blair**, Montgomery (1813-63), lawyer, born Franklin County, Ky.; postmaster general in Lincoln's Cabinet: *picture* L-249
- Blair House**, historic mansion in Washington, D.C.; built about 1824; purchased 1942 by federal government as guest house for distinguished visitors; joined to Lee Mansion and sometimes called Blair-Lee House: W-122, W-31, *map* W-30
- Blaise** (*bláz*), Saint (also *Blair*, *Blasius*, *Blase*), bishop of Sebaste in Asia Minor; martyred A.D. 320; cured a boy choking from fishbone and became patron saint against all diseases of throat; blessing of St. Blaise given annually in Roman Catholic churches, two crossed candles being held under chin; feast day observed Feb. 3.
- Blake**, Edward (1833-1912), Canadian statesman, premier of Ontario 1871-72, Dominion Cabinet member and later Home Rule member of British Parliament: C-100
- Blake**, Lyman (1835-83), inventor, born South Abington, Mass.; designed the modern machine-sewed shoe and machinery to make it: S-163
- Blake**, Nicholas. See in *Index* Day-Lewis
- Blake**, Robert (1599-1657), English admiral B-205
- Blake**, William (1757-1827), English poet, artist, and mystic B-205, E-379
- children's literature**, place in L-272
- quoted** E-379, P-337, T-131
- 'The Infant Jesus Riding on a Lamb'**, *picture* B-205
- Blakelock**, Ralph Albert (1847-1919), landscape painter, born New York City; neglected and insane for 20 years before death.
- Blakeslee**, Albert Francis (1874-1954), botanist, born Geneseo, N.Y.; director Carnegie Station for Experimental Evolution 1936-41; professor Smith College 1942-3; director of its Genetics Experiment Station since 1943
- colchicine experiments** P-307
- Blakesley**, Thomas Holmes (1847-1929), English scientist; civil engineer; improved methods of measuring properties of optical instruments; devised new lenses and spectroscopes; invented portable mercurial barometer.
- Blakiston Island**, an island in the Potomac River; landing place (March 25, 1634) of first settlers sent out by Lord Baltimore; originally named St. Clement's Island.
- Blalock** (*blá'lok*), Alfred (born 1899), surgeon, born Culloden, Ga.; professor of surgery Johns Hopkins University and chief surgeon Johns Hopkins Hospital, Baltimore, Md., after 1941; author of 'Principles of Surgical Care; Shock and Other Problems'; in 1944 with Helen Brooker Taussig (born 1898), physician, originated operation to assist "blue babies."
- Blamey**, Sir Thomas Albert (1884-1951), Australian field marshal; deputy commander in Middle East 1941; commander of all Ground Forces of United Nations in s.w. Pacific, under General MacArthur, 1942-45.
- Blanc** (*blān*), (Jean Joseph) Louis (1811-82), French socialist, at height of fame 1848-49; pioneer of "political," or "government-ownership," socialism, chief outcome of which was gradual adoption in many lands of government ownership of railroads, telegraphs, telephones, water works.
- Blanc**, Cape, on Mediterranean Sea, n. Tunisia, about 5 mi. n.w. of Bizerte.
- Blanc**, Mont ("white mountain"), highest peak of Alps (15,781 ft.), second highest in Europe; 7 mi. in

Key: cape, át, fär, fäst, what, ígll; mē, yēt, fērn, thère; ice, bit; rōw, wón, fōr, nōt, dō; cūre, búrt, rjide, ígll, búrn; out;

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- Blanca Peak in a central Colorado
(14,310 ft.) highest peak Sangre
de Cristo range map C 408 9
- Blanchard (blanch'ard) Jean Pierre
or Francois (1753-1809) French
aeronaut with Dr John Jeffries
made first crossing of English
Channel by air 1785 made first
balloon trip in America 1793
- Blanchard Thomas (1788-1864) in
ventor born Sutton Mass per
fected (about 1816) machine for
making tacks
- Blanche of Castile (1189-1252) Span
ish princess queen of Louis VIII of
France regent during minority of
Louis IX L 318
- Blanchet Francois Norbert (1795-
1853) French Catholic missionary
to trappers and Indians of Oregon
first archbishop of Oregon City
- Blanching
celery C 159 picture C 159
- Blanco (blangk) Antonio Guzman
(1879-99) Venezuelan dictator
(1870-99) made self pres by
revolution 1870 promoted educa
tion and improved economic life
- Blanco (the Whites) political party
of Uruguay U 407
- Blond Edith Nesbit (1858-1924)
English author of children's books
born London England stories of
Bastable children based on own
childhood (Treasure Seekers
'Five Children and Their Story of the
Amulet The Woudbegods')
- Blond James A (1855?-1911) Negro
novelist and song writer born
Fishing Lt wrote words and
music for over 500 songs (Carry
me Back to Old Virginia In the
Evening by the Moonlight Oh
Dem Golden Slippers)
- Blond Richard Parks (1833-99) born
near Hartford KY member House
of Representatives 1872-80 1897-
99 leader of Free Silver move
ment author of *Eland All on Act*
and *Lincoln Act* S 288
- Blondy William Henry Furnell (1890-
1934) U S Navy officer born New
York City in World War II com
manded unit of Pacific Fleet d
rected Army Navy task force in
atomic bomb tests at Bikini 1946
commander of Atlantic Fleet 1947-
50
- Blonks Koen Francina Elsie
(Fanny) (born 1918?) Dutch
track athlete O 390
- Blanketflood See in Index Galliar
dia
- Blanket stitch S 112 diagram S 111
- Blank indorsement of check C 509
- Blank verse P 335
- Shakespeare S 126 128-9 P 335
- Blanchard Richard (1817?-94)
first Canadian governor of Van
couver Island (1849-51) born
England
- Blanco (blan' tr') Nyasaland Af
rica commercial center and mis
sionary headquarters pop 3594
maps E 199 A 47
- Blarney Village in Ireland 5 mi n w
of Cork pop 874 castle contains
Blarney Stone map B 325
- Castle C 480 picture E 1229
- Blaschka Leopold (died 1895) glass
worker of Dresden Germany with
his son Rudolph (1857-1939) fash
ioned many models of botanical
specimens for the Botanical Mus
eum at Harvard University
model of rhododendron color picture
P 145
- Blasco Ibañez Vicente See in Index
Ibañez Vicente B 300
- Blase Saint See in Index Blaise Saint
- Blaser (blä'ser) Gustav (1813-74)
German sculptor outstanding of
period in Germany (Warrior
under the Protection of Minerva
Abraham Lincoln)
- Blashfield Edwin Howland (1845-
1936) mural painter born New
York City noted for idealized and
sentimental figures soft coloring skill
ful composition Development of
Civilization in Library of Congress
paintings in various courthouses
and state capitals
- Westward picture U 389
- Blasius, saint See in Index Blaise
Saint
- Blas furnace for smelting iron I 338
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- Blasting
coal mining M 270
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- Blasting gelatin an explosive derived
from cellulose aurate
Nobel devised D 185
- Blavat sky Helena (Alexandra 1831-
91) Russian theosophist founded
Theosophical Society (1875) wrote
The Key to Theosophy
The Secret Doctrine
Theosophical Glossary
- Blaze horse foundation sire of the
Hackney table H 428
- Bleating star See in Index Liatris
- Bleaching B 95
chlorine used B 205 C 288
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- Black (black) a small silvery Euro
pean fish of the carp family
artificial pearls from scales P 107
- Black House novel by Charles
Dickens plot built upon lengthy
lawsuit of *Jarmyde* vs *Jarmyde*
which was in court almost 50 years
D 845
- Bleeding
clotting of blood B 209 picture
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- How to check first aid F 95-6 pic
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- Bleeding heart a perennial garden
herb (*Dicentra spectabilis*) with
long racemes of drooping heart
shaped rose red flowers introduced
from Japan
- Bleed on tooth shell (*Nerita pila*
rufa) mollusk shell color picture
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- Bluetongue in Gulliver's Travels
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Blende a suicide of a p 2 351
- crystal p figure C 535
- Blended whiskey A 145
- Blenheim (blen'im) Germany Bayer
ian village on Danube 23 mi n w
of Augsburg
battle of (1704) M 98
- Blenheim Palace near Oxford Eng
land M 98
- Blennerhassett Harman (1785-1831)
wealthy Irish lawyer married
wife and was ostracized by family
niece and friends moved to U S 1798
and established magnificent estate
and was known by his name in
Ohio later became involved in
Aaron Burr's conspiracy and was
suicide
- Blennerhassett Island of West
Virginia in Ohio River O 363
- Blenny one of a genus (*Blennius*) of
small spiny rayed fishes whose skin
is covered with silvery matter fish
- quents shallows along coasts mov
ing about among rocks and sea
weeds F 197
- Blériot (blé-rié) Louis (1872-1936)
French pioneer in aviation born
Cambrai studied engineering and
began experimenting with flying
machines in 1900 earliest success
ful flight in plane of his own design
1907 first flier to cross English
Channel July 25 1909—from Calais
to Dover in about 30 minutes
- Blackbok an African antelope closely
related to the hartbeest
- Blackburne (Blackburne) The poem by
Dante Gabriel Rossetti describing
the earning of a young girl in
heaven for her lover on earth Ros
setti also painted the subject
- Bleaching of the Bay early ship built
in American Colonies A 212 B 181
- Blider (blä'ider) steen steen
(1792-1848) Danish lyric poet,
short story writer and novelist
translated Oresan's poem (The
Living Room of silent poems and
stories Old and New Tales con
taining humorous autobiography)
- Blisk & Howells facsimile picture
B 246
- Bligh (blä) William (1754-1817)
English admiral with Capt James
Cook on his second expedition 1772-
74 sent to Pacific in command of
Booby for breadfruit plants to in
troduce into West Indies part of
crew mutinied against Bligh and 20
men to drift nearly 4000 mi in
open boat before landing at Timor
governor of New South Wales Aus
tralia 1800-8 B 299
- Blights various plant diseases B 668
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- chestnut C 226 C 447
- fighting blights with fire picture
L 345
- pea calf P 106
- Blighy slang term meaning home
used by British soldiers during
World War I
- Blimp nonrigid dirigible B 39-1 32 3
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- Bl education of B 206 picture B 206
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ture P 209
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- Blind cell See in Index Congo cell
- Blind fish of Mammoth Cave C 167
- Blind flying See in Index Instru
ment flying
- Blind landing in aviation A 534
- Blind snake blindworm or worm H
said a legless lizard L 282
- Blind spot of human eye E 460 dia
gram D 459
- Blind stamping stamping without
guiding in bookbinding D 241
- Bliss S 7 Arthur (born 1891) Eng
lish composer vigorous and inde
pendent works include orchestral
compositions (*Colour Symphony*
Miscellaneous Fantastique) piano pieces
songs
- Bliss Philip Paul (1855-76) singing
evangelist and writer of gospel
songs born Cleatfield County Pa
taught music became evangelist in
1874 (*The Charm The Sunshine*)
- Bliss Tasker Howard (1853-1930)
U S Army officer born Levisburg
Pa in Spanish American War
became chief of staff U S Army
with rank of general 1917 member
Supreme War Council in France
and American peace commission
1918-19
- Blister skin
treatment of T 87
- Blister beetle or Spanish fly B 107
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potato pest P-392
scientific name B-108
Blister copper C-475
Blister cress. See in *Index* Erysimum
Blister pearl P-107
Blister rust, white pine R-297, *picture* R-298
Blister steel I-247
Blitzkrieg (*blits'krëf*), or "lightning war" W-248
Blitzstein (*blits'stin*), Marc (born 1905), composer, born Philadelphia, Pa.; influenced by Schonberg and other modernists, developed vigorous and original style ('The Cradle Will Rock', musical play, 'Percussion Music').
Blizzard W-150
Bloater, a type of smoked herring, salted and smoked only long enough to dry the fish but not to cure it
Bloc, a combination of political parties or of members of different parties to aid special cause, as "peace bloc," "farm bloc," "labor bloc"
Bloch (*blök*), Ernest (born 1880), American composer, born Switzerland; came to U. S. 1916, director San Francisco Conservatory 1925-30; taught at University of California; many works Jewish in spirit; epic rhapsody 'America' fused patriotic, religious and popular American themes, Indian and Negro folk melodies
Bloch, Felix (born 1905), American physicist and educator, born Zurich, Switzerland; in physics department at Stanford University since 1934, war research Stanford University, Los Alamos, N. M., and Harvard University 1942-45, co-winner with Edward Mills Purcell of 1952 Nobel prize in physics for nuclear induction method
Bloch (*blök*), Jean Richard (1884-1947) French author F-291
Bloch, Adriaen, or Adrian (flourished 1610-24), Dutch navigator who explored Long Island and discovered Housatonic and Connecticut rivers in 1614, Block Island, R. I., named for him, first to map s. coast of New England in detail
Bloch. See in *Index* Nautical terms, *table*
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Crimean War C-514
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mine T-157
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World War II B-207, W-248, 252
Block-and-fault, in geology U-299
Blockhouse, a stronghold, built usually in two stories, of heavy logs banked with earth with loopholes for musketry in sides; used in wars with American Indians and in Spanish-American and Boer wars; *pictures* W-10, W-36, A-220
Block Island, R. I., a small island in the Atlantic Ocean, lying 10 mi. from the shore of Rhode Island; named from Adriaen Block who reached there in 1614; summer resort: map R-141
Block Island Sound, body of water between Block Island and Long Island.
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Japanese. See in *Index* Japan, *sub-head* arts: wood-block prints
playing cards C-121
wallpaper W-4
wood engraving L-386
Block system, on railroads R-66
Block tin, pure tin T-137
Bloemfontein (*blum'fôn-tân*), capital of Orange Free State, Union of

South Africa; pop. 109,130: *maps* S-242, A-47
captured in Boer War B-220
Blois (*blüca*), France, town on Loire, 100 mi. s.w. of Paris; pop. 21,666; splendid castle once seat of counts of Blois: map L-425
Blok (*blök*), Alexander (1880-1921), Russian poet R-295
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Blok, Petrus Johannes (1855-1929), Dutch historian; professor Dutch history, University of Leyden ('History of the Dutch People'; 'A Dutch Town in the Middle Ages').
Blonde lace L-78
Blondel de Nesle (*blôn-dël dü nêl*), French minstrel friend and attendant of Richard I R-150
Blon'din, Charles, real name Jean François Gravelet (1821-97), French acrobat
crosses Niagara on tight rope N-230
Blood, Thomas (1618?-80), called "Colonel," Irish adventurer, stole English crown in 1671 but was arrested getting away, confessed to Charles II who rewarded him by returning his Irish estates
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anemia B-210: folic acid prevents V-496
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Bloody Mary, epithet applied to Mary I, queen of England M-105
Bloomer, Mrs. Amelia Jenks (1818-94), dress reformer and temperance lecturer, born Homer, Cortland County, N. Y.; gave name to bloomers.
Bloomfield, N. J. manufacturing town adjoining Newark; pop. 49,307; Bloomfield College and Theological Seminary: map, inset N-164
Bloomfield-Zeiser, Fannie (1866-1927), American concert pianist born in Austrian Silesia; one of foremost women musicians.
Blooming mill, in iron and steel industry I-244a
Bloomington, Ill. city 37 mi. n.e. of Springfield in corn belt; pop. 34,163; railroad shops, stove and furnace manufactures, Illinois Wesleyan University: maps I-36, U-253
Bloomington, Ind. city 46 mi. s.w. of Indianapolis; pop. 28,163; vast quarries of Bedford lime-stone, furniture factories: map I-79
Indiana University: Memorial Union Building, *picture* I-82
Bloomshurg, Pa., town 37 mi. n.e. of Harrisburg; pop. 10,633; textiles, carpets, rugs, hosiery; canneries; flower growing; State Teachers College: map P-133
Bloomsbury, district in London, England L-305
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Blotting paper, why absorbs ink C-119
Blount, Paul. See in *Index* O'Reil. Max
Blougram, Bishop, in Robert Browning's 'Bishop Blougram's Apology', skeptical, worldly churchman.
Blount, William (1749-1800), political leader, born Bertie County, N. C.; in 1790 appointed governor of the "Territory South of the River Ohio" by President Washington; signed United States Constitution for North Carolina; made his headquarters in Tennessee; elected to U. S. Senate from Tenn.; expelled from Senate because of his part in conspiracy to seize Spanish territory in America for England. His was first impeachment trial ever brought before U. S. Senate.
Blowfly. See in *Index* Flesh fly
Blowgun. See in *Index* Blowpipe
Blowing machines, devices for producing currents of air. See also in *Index* Pneumatic appliances
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ventilating device M-270
Blown glass G-122b-3, *picture* G-122b, *color pictures* G-124, R-145
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Blowpipe, or blowgun, a tube of wood or bamboo for blowing darts; used for hunting birds and small animals, by Indians of s. U. S. and South America and by natives of East Indies; the darts are sometimes poisoned for use on big game or human enemies

Key: cape, dt, far, fäst, what, fgl, mc, yct, fcrn, there; fce, bit; row, wón, fór, nót, dg; cáre, bú, ryde, fyll, bárn; out;

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Blowpipe oxyhydrogen H 450
Blubber layer of fat beneath skin in certain animals
Blow W 112
Blücher (Blücher) Gebhard Leberecht von (1774-1819) prince of Wahlstatt Prussian field marshal leader of patriot Prussian party during Napoleonic period
at Waterloo W 68
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Blueback salmon sockeye salmon or red salmon S 28
Bluebeard Villi in French fairy tale (Barbe Bleue) by Charles Perrault his wife Fatima disregards command not to open a certain door and discovers bodies of the six wives he had murdered she is rescued just in time similar stories exist in folklores of other countries
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Bluebell See in Index Lungwort
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Blue Bird the fairy play by Maurice Maeterlinck first produced in Belgium in 1909 M 28
Blue Birds junior organization of Camp Fire Girls C 54
Bluebonnet a blue flower of the pine genus B 212 picture B 212 color picture S 384a
Blue Boy the full length portrait of Jonathan Buttall by Thomas Gainsborough supposedly painted to disprove Sir Joshua Reynolds statement that coll color (such as blue) could not be used as the dominant color in a painting G 1
Blue butterfly a small azure butterfly of the family Lycaenidae caterpillar and pupa color picture B 366
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Blue catfish C 138 139
Blue disease C 208
Bluecoat school nickname for Christ's Hospital school in London blue lani t students wear long blue coats L 88
Blue crab C 503 505 picture C 504
Blue daisy a name for heliopsis See in Index Felicia heterophylla
Blue darter See in Index Coopers hawk
Blue Ensign flag of Canada P 136a color picture S 131
Blue eyed African daisy See in Index Arctotis
Blue-eyed grass perennial wild flower of iris family common species (Star Alt n g altissim) 4 19 in high with long grasslike leaves 6 petalled blue flowers about 1 in across have yellow or white centers Canada and U states May July color picture F 172
Blue eyed Mary See in Index Collinsia
Bluefield town on Va and W Va border w of Roanoke distributing center for Pocahontas coal field P 10 in W Va 21 000 in Va 4 019 railroad sh 1 r 1 a o working plants Bluefield State College maps W 106 V 488 L 243 Mt wells N 100 P 111 n coast pop 461 V 233 map C 112
Bluefield State College at Bluefield W Va state conf L opened 1898 liberal arts education
Bluefin tuna fish T 205
Blue fir See in Index White fir
Bluefish F 114
Blue flag a species of iris I 232
Blue fox F 253
Bluegill fresh water fish (Helleoperca) member of the sunfish (Centrarchidae) family named from blue color of cheeks and gill covers general color greenish ground food fish abundant in most parts of the United States S 454 color picture F 117
Bluegrass any of various species of the genus Poa especially the Kentucky bluegrass it has many running rootstocks which form a dense sod and grows from a few inches to two feet high grows especially well in limestone regions of Kentucky and Tennessee Kentucky K 21 23 lawn planting G 15
Bluegrass State popular name for Kentucky K 25
Blue grouse K 219
Blue gum a eucalyptus E 415 T 2
Blue hawk or hawked a falcon F 15
Blue hen chicken game chicken D 68
Blue bird of Delaware table B 158
Blue Hen State popular name for Delaware D 60
Blue heron great H 350 picture J 349 color picture B 180
Blue heron little I 351
Blue Island the manufacturing and commercial city just w of Chicago limits pop 17 600 map inset 1 38
Blue Jay J 330 picture J 328 color picture B 185
nest, color picture B 165
Blue face flower See in Index Trachymene
Blue laws any laws designed to regulate the ordinary habits or morals of individuals particularly in Connecticut the strict laws of Puritan days L 373
Blue lead a basic lead sulfate mixed in small quantities of lead sulfide lead sulfate zinc oxide and carbon a by product of lead smelt in the color varies from gray to white used as a paint coloring
Blue lodge in Freemasonry F 283
Blue Mountain in Arkansas See in Index Magazine Mountain
Blue Mountain a college at Blue Mountain Miss Baptist for women founded 1873 liberal arts and sciences
Blue Mountains Australia in Great Dividing range picture N 185
Blue Mountains Oregon in n 8000 to 9000 ft high densely forested area C 408 417
Blue Mountains (also Kittatinny and Nittany) e Pennsylvania P 122 123 P 122 134
Blue mud darter a wasp W 52 color picture W 51
Blue Network a radio R 48
Blue Nile River or Abba (ab ba) River in Africa rises in Ethiopia unites with White Nile near Khartoum N 237 S 1 403 map A 46 table picture F 401
Blue notes in n 10 E 465
Blue Peter rectangular blue flag with rectangular white center when hoisted along at top of foremast sign has its ready to sail
Blue Point N 1 Village a Long Island near shore of Great South Bay w of Patchogue pop 161 water center L 311
Blue rock system of water suitable for drinking raw found near Blue Point Long Island run low sea for any system of same type C 437
Blueprint B 212
paper picture P 216
Blue racer snake N 208
Blue Ridge Mountains southeastern most range of Appalachian Mts maps U 250 285 275 V 480 486-7 N 268
Mary and M 109
North Carolina picture A 267 physiograph province A 278 diagram A 276
Shenandoah National Park N 350-c map N 18 picture V 491 color picture N 20
Virgin A 478
Blue Ridge Parkway joins Shenandoah and Great Smoky Mountains national parks N 38c R 102
Blue sage several perennial plants of the sage family members of the genus Salvia L. Flowers are soft blue to azure blue and grow in whorls on slender stems
Blue sea slug or nudibrach C 136
Blue spruce or Colorado spruce C 358
Blue stemmed goldenrod C 135
Bluestocking term applied to a letter a woman originated in 18th century when a guest at an exclusive literary gathering in London wore blue stockings
Bluet a small wild flower (Houstonia missouriensis) of the madder family with delicate blue violet or nearly white flowers with yellow centers native from Nova Scotia Canada to Georgia and Missouri also called innocence color picture F 174
Blue Taverier famous diamond picture D 79
Blue vitriol copper sulfate S 448 C 475
Blue Water International Bridge over St Clair River between Port Huron Mich and Sarnia Ontario Canada
Blueted See in Index Viper's bugloss
Blow whale W 114 picture W 115
Bluffton College at Bluffton Ohio Mennonite founded 1930 arts and sciences
Blow and go process and container used in laundry water to neutralize the yellow tint of white clothes
Blum Léon (1879-1940) French premier 1976 37 first Socialist premier born in Alsace also writer and critic imprisoned by Vichy regime 1941 tried for war guilt in 1947 then held by Germans until 1948 premier (interim president) Dec 1945-Jan 1947 vice premier July-August, 1946

- Blum, Robert Frederick** (1857-1903), artist, born Cincinnati, Ohio; most noted for easel paintings and murals; also etcher, illustrator ('Moods of Music' and 'The Dance', murals; 'Venetian Lacemakers', figure painting).
- Blumenbach** (*blō'mēn-bāk*), **Johann Friedrich** (1752-1840), German naturalist and anthropologist, born Gotha; founded science of anthropology; placed comparative anatomy on scientific basis; classified mankind into five races R-21
- colined name Caucasian race C-156
- Blumenschein, Ernest Leonard** (born 1874), artist, born Pittsburgh, Pa.; accurate portrayal of subjects; chiefly known for paintings of the Taos Indians of New Mexico.
- Blunderbuss**, a gun F-80
- Blunger**, in pottery making P-399
- Blunt, Wilfrid Scaven** (1840-1922), English traveler and poet; attached to various British embassies in Europe; took part in Irish freedom movement; wrote emotional verse, often in style of Byron, whose granddaughter he married ('Love Sonnets of Proteus'; 'Esther'; 'Griseida'; 'India Under Ripon').
- Blr, Nellie**. See in *Index* Seaman, Elizabeth Cochran
- Blithe, Samuel George** (1868-1947), journalist and writer, born Geneseo, N.Y.; had been editor and writer for a number of magazines and newspapers; staff writer *Saturday Evening Post* after 1907 ('We Have With Us Tonight'; 'The Revolt of Peter Purdy').
- Blytheville, Ark.**, city about 55 mi. n. of Memphis; pop 16,231; clothing, cotton oil, soybean oil; maps A-367, U-253
- B'nai B'rith** (*bnā brith*), Independent Order of, a Jewish fraternal organization founded in New York City in 1843 for the moral improvement of its members and the furtherance of "charity, benevolence, and brotherly love"; has branches throughout the U. S., in Europe, and the Near East; name means "sons of the covenant."
- Boa**, a genus of nonvenomous serpents of tropical America, belonging to Boidae family; prey killed by crushing in coils; important species, anaconda and boa constrictor: B-212, S-206, 209, pictures S-207
- Boabdil** (*bō-āb-dēl'*), or **Abu Abdullah**, last Moorish king of Granada (1482-92); conquered and dethroned by Ferdinand II, king of Aragón.
- Boa constrictor** B-212, S-206, picture S-207
- Bondieca** (*bō-ād-i-sē'ā*), also **Bonduca** or **Bondicea** (died 62 A.D.), queen of the Iceni, a tribe in ancient Britain; took poison after defeat of her army by Romans; subject of poems by Tennyson and Cowper and of tragedy, 'Bonduca', by Beaumont and Fletcher: E-357
- Boanerges** (*bō-g-nēr'gēs*), "sons of thunder," name given by Jesus to the disciples James and John.
- Boar**, mature male hog, also the popular name for various wild hogs, particularly the European and the Indian wild hog B-212-13, picture B-212
- Adonis myth** A-22b
- ancestor of domestic swine H-404
- boar's head procession C-297-8, 299, picture C-297
- bristles used for brushes P-42
- Boardman, Russell** (1898-1933), American aviator
- New York to Istanbul, Turkey, flight A-105
- Board of Governors, Federal Reserve System** F-49, 50
- Board of Health, or Health Department**. See in *Index* Hygiene; Public health
- Board of Trade Building**, Chicago, map C-231b, picture C-237
- Board of trustees**, of college U-402
- Boards of education** E-258
- Boards of trade** B-213-14, pictures B-213
- cotton exchange "ring," picture C-496
- grain exchange, operation E-227-8
- records U-365
- Boar's head procession**, Christmas custom C-297-8, 299, picture C-297
- Boas, Franz** (1858-1942), American anthropologist, born Germany; explored Baffin Land, made expeditions in Mexico and Puerto Rico; professor of anthropology at Columbia University 1899-1937; curator of anthropology, American Museum of Natural History 1901-5 ('The Mind of Primitive Man'; 'Anthropology and Modern Life'; 'Race, Language, and Culture').
- Boat** B-214-19, pictures B-214-18. See also in *Index* Canoes and canoeing; Motorboat; Navigation; Sailing craft; Shipbuilding; Ships; Steam craft
- Amazon River craft**, picture A-185
- balsa**, on Lake Titicaca, picture B-222b
- barge, cargo, pictures E-421, I-29, M-309, M-322, R-133
- basket boats B-74, B-217, pictures B-218, B-222b
- Borneo**, picture B-256
- Burma**, picture B-360
- canalboat of middle 1800's C-107, picture C-109
- canoes distinguished from B-214
- catamaran B-219, picture B-218
- Chinese C-264, C-116, A-416, pictures C-264, 266, 269, 273, S-153
- Coast Guard lifesaving boats L-225
- coracle B-217, picture B-218
- early types B-217-19, T-170d, S-149-50, pictures B-218
- ferryboat S-159, picture N-221: colonial, picture A-205
- flatboats P-264, pictures M-309, P-265; fur trader's, picture F-40
- glass-bottomed: Santa Catalina I-land L-316
- gondola, picture V-445
- goofah B-217, picture B-218
- houseboats: Chinese C-264, C-116, A-416, picture C-264
- hulls, various types B-216
- Indians, North American B-155, B-219, C-113, 114, pictures C-113, I-102, 106d
- junks C-264, pictures C-273, S-153
- kavak C-114, pictures E-396, B-218, G-214
- motorboats M-436-8, pictures M-437
- outrigger B-219, pictures P-13, B-218
- rowboats and rowing F-115
- trolling boat, picture F-113
- tugboat, or towboat, pictures C-233, I-29, R-133, S-149
- Boatman**, water. See in *Index* Water boatman
- Boat racing**
- Chinese Dragon Boat Festival, picture C-269
- college contests B-215: Oxford University O-434
- Isle of Wight W-133
- yacht racing B-216
- Boatswain** (*bō's'u* or *bōl'swān*), subordinate naval officer on a war vessel in charge of rigging, anchors, cordage, etc.; summons crew to duty insignia, picture U-237
- Boat-tailed grackle** B-203
- Boaz** (*bō'āz*), in the Bible, 2d husband of Ruth R-299
- 'Bob, Son of Battle'**, realistic story of Old Bob, champion and faithful sheep dog, by Alfred Ollivant; first published 1898.
- Bobber**, in fishing F-118a, list F-118g
- Bobbinet**, a machine-made net of cotton or silk yarns partially twisted around one another to form hexagonal meshes; used for dresses, trimmings, draperies, linings.
- Bobbing wheel**, for spinning S-350, picture S-349
- Bobbin lace**, or pillow lace L-77, picture L-79
- "Bobby,"** nickname for British policeman P-356
- Bobcat**, the American lynx L-355
- Bobolink**, or rice bird B-219, picture B-219, color pictures B-166, 184
- migration M-242, B-219, map M-241
- nest, color picture B-166
- Bobbeds** W-160, picture W-159
- Bobwhite**, North American quail Q-1-2, picture Q-2, color picture B-180
- altitude range, picture Z-362
- feeding habits B-158
- state bird, table B-158
- Bocaccio** (*bōk-kā'chō*), **Giovanni** (1313-75), "father of Italian prose," author of the 'Decameron', a storehouse of characters and plots used by Chaucer, Shakespeare, and others: R-104, picture I-250
- Dante** lectureship D-14n
- scene of 'Decameron' B-203
- Tuscan dialect I-259
- Bocherlin** (*bōk-kā-rē'nē*), **Luigi** (1743-1805), Italian composer and violoncello virtuoso; court musician at Madrid ('Minuet').
- Bocconi** (*bōt-chō'nē*), **Umberto** (1862-1916), Italian futurist sculptor and painter, born Reggio di Calabria, Italy: S-83
- Bocconia**. See in *Index* Plume poppy
- Bochum** (*bōk'əm*), Germany, industrial city 8 mi. e. of Essen; pop. 289,804; coal mines, iron and steel works; map, inset G-88
- Bock, Vera**, artist, illustrator, and designer of books, born St. Petersburg (now Leningrad), Russia, of American father and Russian mother. During Russian Revolution, she and her family fled to San Francisco, Calif. Illustrated for children: 'The Oak Tree House', 'A Ring and a Riddle', 'Arabian Nights', 'King of the Cats'; for adults: 'The Koran', 'Phantom Victory' illustration, picture S-499
- Böcklin** (*būk-līn'*), **Arnold** (1827-1901), Swiss painter, born Basel, Switzerland; his fantastic and weird paintings, marked by poetic perception, are rich in color and original in composition ('Sea Idyl'; 'Venue Reposing'; 'Isle of Death').
- Bodanzky** (*bō-dān'ski*), **Artur** (1877-1939), American conductor, born Vienna, Austria; from 1915 principal conductor of German opera for Metropolitan Opera Company, New York City.
- Bode** (*bō'dū*), **Johann Elert** (1747-1826), German astronomer, director of Berlin Observatory; Bode's law named for him: A-426
- Bodensee**. See in *Index* Constance, Lake
- Bode's Law**, a system of figures for establishing the relative distances of the planets from the sun, propagated by Johann Elert Bode in 1795, but discovered about 1772 by Johann Daniel Titius of Wittenberg: A-426
- Bo'dhi tree**, or **Bo tree**, the sacred fig (*Ficus religiosa*) under which the Buddha is supposed to have received the inspirations on which the

Key: cape, āt, fār, fāst, whāt, fyll; mē, yēt, fērn, thēre; ice, bīt; rōw, wōn, fōr, nōt, dō; cūre, būt, ryde, fyll, būrn; out;

Buddhist religion is founded The
pical tree outside the temple at
Bodhi Gaya India and the one in
Anuradhapura, Ceylon are revered
as descendants of original C 180
Bodleian (bôd i-ən) Library Oxford
University England L-183 pictures
O 433 434
Bodley Sir Thomas (1545-1613)
English scholar and diplomat
sent by Queen Elizabeth I on diplo-
matic missions to Denmark France,
and Holland L-183
Bodmer (bôd mēr) Charles (1809-
93) Swiss artist in United States
1832-34 making copper plates for
Prince Maximilian's Travels in
the Interior of North America
Mandan Indian earth hut, picture
I 104
Bodoni (bô-dô-nî) Giambattista
(1740-1813) Italian printer super-
intendent of duke of Parma's pri-
vate presses printed beautiful
editions of the classics T 230
style of type picture B 235
Body human See in Index Anatomy
Physiology
Body lice or sucking lice a group of
insects of the order Anoplura
family Haematopidae especially
the hog louse (*Haematopis ad-
venticulus*) the largest species 6 to
12 generations a year P 77-8 color
picture I 154b
human body louse picture P 79
Body of Civil Law (*Corpus Juris civ-
ilis*) compiled by Justinian J 367
Body pigments in paints P 40
Boehmeria (bô mēr i-ə) a genus of
plants shrubs, and trees of the nettle
family including China grass or
ramie See also in Index China grass
Boeing William Edward (born 1841)
airplane manufacturer born De-
troit, Mich. instructed in flying by
Glen L. Martin founded Boeing
Aircraft Company 1916 Daniel
Guggenheim medal (1934) for suc-
cessful pioneering and achieve-
ment.
Boeing Aircraft Company in Seattle
Wash. S 93
Boeotia (bô-dî-ə) district of an-
cient Greece n.w. of Attica Thebes
chief city T 115 map G 197
early alphabet A 179
Boer (bô) (bô r-ə) Hermann
(1868-1912) Dutch physician pro-
fessor at University of Leyden used
scientific methods in classifying and
treating disease author of books
on medicine and chemistry
Boeroe (bô-rô) or Bura Island of
Meluccia group Indonesia w. of
Ceram about 3400 sq. mi. pop.
19 525 exports saago timber cajuput
oil maps E 203 P 16
Boers (bôrz) Dutch farmers of South
Africa See also in Index Boer War
British early relations with S 244
Orange Free State O 402
Transvaal settled T 175
World War I rising S 202
Boer War (1899-1902) B 210-20
events leading to S 244-5
leaders Kitchener K 52 Rhodes
R 144 Roberts R 163 Smuts S 202
Lloyd George opposes L-285
Boethius (bô-dî-ūs) (about 480-
524) Roman statesman and philoso-
pher (*Consolations of Philosophy*)
translated by King Alfred
and by Chaucer
Bofoa rampion picture M 10
Boe spongy wet ground usually com-
posed of decaying vegetable matter
and covered with coarse grass See
also in Index Swamp
peat bog P 125 9
quaking M 406
Boğazi as La. lumber manufacturing
town on Pearl River 60 mi. n. of

New Orleans pop. 17 798 L-324
maps L-331 U 243
Bogan Louise (born 1897) poet born
Livermore Falls Me. (*Body of This
Death*, *Dark Summer*, *The Sleep-
ing Fury*, *Poems and New Poems*)
Bogardus James (1800-1874) inven-
tor born Catskill N. Y. watch
maker by trade invented gas meter
pyrometer method for printing
postage stamps (1839) adopted by
British government built (1847)
the first building using cast iron
beams
Bogaz Kei also **Boghaz Keui** (bô
gas kei) village in Turkey 85 mi.
e. of Ankara near ancient ruins
cuneiform tablets A 300 H 385-6
Boghas ichi strait See in Index Bos-
porus
Bogor Java See in Index Buitenzorg
Bogotá (bô-gô-tá) capital of Colom-
bia pop. 645 245 B 220 C 388
maps C 387 S 252 picture B 220
conference on Inter American co-
operation (1948) L-123
Bolfe La (*la bô-fê*) opera by
Puccini story O 389
Bohemia westernmost province of
Czechoslovakia B 290-1 C 535
536 maps C 535 A 497 E 494-6
cities Prague P 405 6 picture P 405
commerce products and industries
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emigration to U. S. I 46
glass button industry B 372
history B 221 Celta C-163 Huss
and Hussite War H 452 Thirty
Years War T 118 picture T 118
World War I B 291 World War II
C-536
John Huss Day F 59
language H 452
national song N 42
Bohemian Forest (German *Böhmer-
wald*) chain of mountains between
Bohemia and Bavaria highest peak
Arber (4370 ft.) map C 535
Bohemian garnet J 349
Bohemian (bô-mî-ən) light opera
first produced in London England
1843 music by Michael William
Balfe words by Alfred Bunn fa-
miliar songs I Dreamt That I
Dwelt in Marble Halls and Then
You'll Remember Me
Bohemians a popular term for uncon-
ventional people B 221
Bohemians or Czechs a Slavic people
B 220-1 See also in Index Czechs
Bohemian waxing a small perching
bird W 78
Bohemond (bô-hê-mônd) (1052?-
1111) Norman crusader C 519 pic-
ture M 235d
Böhlen (bô-lên) Helene (born 1859-
1910) German novelist and short
story writer wrote *Haltier* (Half
Animal) and *Ratensiedel* (h
ten (Stories to Counselor's Daugh-
ters) G 85
Böhme (bô-mê) or *Böhm* (bô-m)
Jakob (1576-1642) German theo-
logist and mystic held nothing ex-
traordinary is intelligible except through
its opposite
Bohr (bôr) Niels Henrik David (born
1885) Danish scientist B 221 pic-
ture P 156
atomic power project table A 464
theory of atomic structure S 333-4
E 344/f diagram E 344e
Böhus castle Sweden near Göteborg
S 463
Boileau (bô-lô) Nicolas (1636-
1711) French poet, satirist, and
critic called *Laureate* of France
critic called *Laureate* of France
critic, full name *Boileau Despréaux*
(*Epistles*, *The Art of Poetry*)
critic in France H 322
Boller in steam engine S 387 389
Boller of furnace S 387 389
dynamo S 387
early types S 390

Boiling cookery C 463
Boiling d distinguished from evapora-
tion W 63 H 319 20 L 263-4
Boiling point W 63 H 319 20 L 263-4
lowering and raising W 63 vacuum
lowers V 431
measured by thermometers T 116
mercury M 174
solutions S 234
water W 63
Bois de Boulogne (bô-dê bô-lôn-yô)
park in Paris France 2100 acres
on north side of Seine River fa-
mous for fashionable promenades
formerly a site of duels and rob-
beries P 8* 85 map P 82a
Boise (bô-i-se) Idaho state cap-
ital and largest city n.w. on Boise
River pop. 34 983 B 221 I 95
maps I 91 U 252
top to State picture I 25
hot springs I 14
irrigation project I 251
Bois Guilbert (bô-i-gûl-bêr) Brian
le Knight n. Sr. Walter Scott's
Ivanhoe
Bois-le-Duc See in Index a Hertog
genbosch
Boito (bô-i-to) Arrigo (1847-1918)
Italian composer and poet be-
t known for opera *Metastase* based
on Goethe's *Faust* also wrote
libretti for operas by Verdi (*Otello*
and *Falstaff*)
Bojer (bô-jêr) Johan (born 1872)
Norwegian novelist set an orphan he
was brought up by a laborer's
family spent many years abroad
particularly in France as news-
paper correspondent wrote real-
istic novels of Norwegian life with
simple treatment, somber tone
(*The Great Hunger*, *The Power*
of a Lie, *The New Temple*, *The*
Everlasting Struggle)
Bok Edward William (1863-1930)
American editor writer and ph-
lanthropist born Den Helder
Netherlands in U.S. after 1870
became citizen editor in chief of
The Ladies' Home Journal 1889-
1919 won 1901 Pulitzer prize for
The Americanization of Edward
Bok autobiography
Singing Tower F 152-3 picture
F 162
Bokhara Russia See in Index Bu-
khara
Boknafjord also *Bukhtenford* arm of
Atlantic in s.w. Norway 10 to 15
mi. wide extending 35 mi. inland
just s.w. of Hardangerfjord map
N 301 E 424
Bola in saule used by gauchos A 331
S 262
Bolama (bô-lâ-ma) port of Portuguese
Guinea w. Africa pop. 4000 on
island of same name point of de-
parture for transatlantic airplane
route
Bolan (bô-lan) Pass picturesque
defile 55 mi. long in Baluchistan
near Quetta main highway from
Kandahar to Indus Valley map
P 158
Boldredwood Rolf (pen name of
Thomas A. Browne (1825-1915)
Australian novelist wrote many
tales and novels of Australian ad-
venture work descriptive and full
of local color popular works in-
clude *Robbery under Arms*, *The*
Miners' Right, *The Squatter's*
Dream, *A Tale of the Golden West*
Bolero (bô-lô-rô) Spanish dance
in triple time generally accom-
panied with castanets introduced
about 1780 and thought to be of
Moroccan origin also the music
for the dance particularly com-
positions by Ravel and Moszkowski
in costume a short jacket, with or

w=French u German u germ go thin then u=French nasal (Jean) zh=French f (z in azure) k=German guttural ch

- without sleeves, resembling coat worn by Spanish peasants.
- Boleslav I** (*ból'sláv*), or **Boleslaw** (called "Chrobry," the Great or Mighty) (died 1023), king of Poland 992-1025; raised Poland from poor, struggling principality to great power of Europe, extending from Bug to Elbe rivers and from Baltic Sea to the Danube.
- Boleyn** (*bul'in*), Anne (1507-36), 2d queen of Henry VIII of England B-221, H-338
- Bolger** (*ból'gér*), Ray (mond Wallace) (born 1904), actor and dancer, born Boston, Mass., professional stage career began 1922; has appeared in motion pictures ("Wizard of Oz," "Where's Charley?"), musical comedies ("On Your Toes," "Where's Charley?"), and television; during World War II entertained soldiers in many combat areas under auspices of United Services Organizations: D-144
- Bollingbroke** (*ból'ing-brúk*), Henry St. John, Viscount (1678-1751), English statesman, orator, and writer; negotiated treaty of Utrecht (1713); intriguer for Stuart restoration; talented but unscrupulous.
- Boltho** (*ból'thō*), William, pen name of William Bolitho Ryall (1890-1930), British journalist and writer, born Capetown, South Africa (Italy under Mussolini), political prose; "Twelve against the Gods", biographical studies
- Bolivar** (*ból'é-vár*, Spanish *ból'é-rár*), Simón (1783-1830), South American general and statesman B-221-2, L-113, picture L-114
- flag F-138, color picture F-136
- Panama Congress called by L-120
- San Martín and S-42, 43
- Bolívar**, a gold or silver coin, a monetary unit of Venezuela, historical value about 20 cents; name applied also to 10-boliviano gold coin of Bolivia, historical value about \$3.65.
- Bolivia**, inland country of South America; area 420,000 sq. mi.; pop. 3,028,031; cap. La Paz: B-222-4, maps B-288, S-252-3, pictures B-222-4, Reference-Outline S-279
- agriculture B-222a-3
- Andes Mountains A-244
- cities B-224, list B-222a
- La Paz L-101
- climate B-222a-b
- education B-223-4
- exports and imports. See in Index Trade, table
- flags F-138, color picture F-136; Bolívar F-138, color picture F-136
- government B-224
- history B-224; war with Chile C-256, B-224
- illiteracy B-223
- Independence Day F-59
- Indians B-222a, 222b-3, S-263, pictures B-222a, b, 223, 224, P-142b, S-250
- industries B-224
- language B-224
- literature L-126
- mines and minerals B-224, list B-222a: tin B-224, pictures B-222a, L-119
- natural features B-222-222a, list B-222a
- people B-222b: how the people live B-222a, 222b-3, S-263
- products B-222a-3, 224, list B-222a: alpaca wool A-176; bismuth B-198
- relationships in continent, maps S-252-3, 255-7, pictograph S-246
- religion B-224
- transportation B-224
- Bolivia cloth**, a class of woolen or worsted pile fabrics used for coats, sold under different trade names.
- Boliviano** (*ból'é-ré-á-nó*), a monetary unit of Bolivia, historical value 36½ cents.
- Boll** (*ból*), seed capsule of cotton C-493-4, pictures C-491, 494
- Bollard**. See in Index Nautical terms, table
- Boll weevil** W-85, C-493, picture C-492
- how to combat W-85
- monument to A-112, picture A-115
- Bollworm**, pink, a moth (*Pectinophora obscura*) injurious to cotton I-163
- Bolm**, Adolph (1884-1951), American dancer and choreographer, born St. Petersburg (now Leningrad), Russia, choreographer for Russian Imperial Ballet, later with Diaghilev Ballet, ballet master for Chicago Opera 1923-25, staged many theater and motion-picture ballets: D-14, 1
- Bologna** (*ból-lón'yá*), Giovanni da, also Giambologna (1524-1608), Italianized name of the French-born Jean Boulogne, one of greatest sculptors of Renaissance S-78c-d
- Bologna**, city of N. Italy; pop. 338,710. B-224-5, maps I-262, E-425
- Bologna**, University of, Bologna, Italy, one of oldest European universities, started about 1100, chartered 1158; famous for law and medical courses; early admitted women as students and teachers: B-225
- first stationers B-237
- law school U-404
- Bolometer** (*ból-lóm'é-tér*), extremely sensitive instrument for detecting and measuring infrared rays through change in electrical resistance of a conductor I-149
- invented by S. P. Langley L-97
- Bolshevism**, doctrines of the radical wing of the Russian Social Democratic party R-288-9. See also in Index Communism
- counterrevolutions of the "Whites" W-240-1
- imperial family killed N-234
- Lenin L-162
- Marxism basis of doctrine M-105
- Trotsky T-192
- Bolson** (*ból'són'*), in desert D-73
- Bolte** (*ból'tá*), Charles Lawrence (born 1895), U. S. Army officer, born Chicago, Ill.; in World Wars I and II; became 4-star general 1953; commander in chief U. S. Army in Europe April-Sept. 1953; Army vice-chief of staff 1953-55.
- Bolting**, in flour milling F-167, picture F-166
- Bolton**, Herbert Eugene (1870-1953), historian, born Wilton, Wis.; at University of California after 1911 as professor of American history, later as chairman department of history and director of Bancroft Library; authority on Spanish-American history ("Texas in the Middle 18th Century"; "Anza's California Expeditions"; "Spanish Borderlands"; "Outpost of Empire")
- deciphers Drake plaque C-45
- Bolton**, also Bolton-le-Moors, England, cotton-manufacturing borough in Lancashire 11 mi. n.w. of Manchester; pop. 167,162; home of Samuel Crompton and Richard Arkwright: map B-325
- Boltonia**, a perennial bushy-branched plant of genus *Boltonia* of the composite family; has asterlike flowers with white, pink, or purple rays and yellow disks; also called false chamomile.
- Boltwood**, Bertram Borden (1870-1927), specialist in radioactivity, born Amherst, Mass.; professor radiochemistry, Yale University (1910-27).
- Boltzmann**, Ludwig (1844-1906), Austrian physicist, born Vienna; noted for work on thermodynamics and kinetic theory of gases.
- Bolzano** (*bólt-sá'nó*) (German Bozen), province in Italian Tyrol, formerly belonging to Austria-Hungary; pop. 334,115; picturesque mountainous country; fruit-growing region: T-232b
- Bolzano**, or Bozen, Italy, town in province of same name near the confluence of the rivers Talavera, Isarco, and Adige; winter resort of Gries on opposite bank of Talavera; fine 14th-century Gothic cathedral; pop. 69,605, with suburbs: maps I-262, E-416, 425
- Boma**, properly Mboma, port and former capital of Belgian Congo; 60 mi. inland on n bank of Congo River; pop. 20,531: map A-47
- Bomb**
- atomic See in Index Atomic bomb
- glide, or glider G-225, 226
- rocket. See in Index Rocket, subhead weapon in war
- Bombard**, cannon of early type A-400
- Bombardier** (*bóm-bér-dér*) beetle B-104, picture B-107
- Bombay** (*bóm-bá'*), state of India on w. coast; pop. 35,956,150; 76,443 sq. mi.; cap. Bombay: B-225, I-64, map I-68a
- Bombay**, largest city of India, on w. coast, capital of Bombay state; pop. 2,629,270: B-225, maps I-54, A-531, A-407, pictures I-61, 64
- cities, world's largest. See in Index City, table
- Bombay hemp**. See in Index Sunn
- Bombazine**, a twilled cloth of silk and worsted.
- Bombé**, or bulging, furniture design I-179
- Bombidae**, bumblebee family B-100
- Bombing plane**. See in Index Aviation, military and naval, subhead bombing plane
- Bombsight**, a device for aiming bombs, especially one devised for precise use at high altitudes; Norden bombsight used in World War I cost \$8,000 and weighed 50 pounds; K-1 system in use in 1952 cost \$250,000 and weighed 2000 pounds: picture A-81a
- Bombycidae** (*bóm-bis'é-dé*), family of moths; includes the silkworm moth.
- Bombycillidae** (*bóm-bé-sil'é-dé*), waxwing family of birds W-76
- Bomu River**, also Mbomu, a partly dried-up watercourse on n. boundary of Belgian Congo, map B-109
- Bon** (*bón*), Cape, in Africa, on n. e. coast of Tunisia T-207, map A-46
- Bona**, Algeria. See in Index Bone
- Bonaire**, island in Netherlands West Indies, just n. of Venezuela; area 95 sq. mi.; pop. 4995; exports sisal: map W-96a
- Bonaparte** (*bón'ng-párt*), famous Corsican family B-225-6
- Bonaparte**, Caroline (died 1839), sister of Napoleon I; married Murat: B-226
- Bonaparte**, Charles (1746-85), father of Napoleon I B-225
- Bonaparte**, Charles Joseph (1851-1921), American statesman, born Baltimore B-226
- Bonaparte**, Elisa (1777-1820), sister of Napoleon I B-226
- Bonaparte**, Jerome (1784-1860), youngest brother of Napoleon I; king of Westphalia: B-226
- Bonaparte**, Joseph (1768-1844), eldest brother of Napoleon I; king of Naples, later of Spain: B-225
- General Hugo** adviser to H-440
- Bonaparte**, Louis (1778-1846), king of Holland, brother of Napoleon I B-225-6

Key: cape, át, far, fást, what, fáll; mé, yét, fèrn, thère; ice, bit; rów, wón, fór, nót, dō; cūre, bútt, rýde, fýll, búrn; out;

Bonaparte Louis Lucien Prince (1813-91) French philologist son of Lucien Bonaparte investigated Basque language also phonetic character of European languages
Bonaparte Lucien (1775-1849) prince of Canino brother of Napoleon I B 225

Bonaparte Maria Letizia Ramolino (1780-1876) called Madame Mère (mère) mother of Napoleon I B 225

Bonaparte Napoleon See in Index Napoleon I

Bonaparte Pauline (1790-1825) sister of Napoleon I B 225

Bonaparte's gull C 230

Bonaventura (bo na ven tu ra) Saint (1521-74) Italian theologian general of Franciscan order and cardinal real name Giovanni Tildanti revered as a theologian and for his spotless character. Biblia Pauperum (Poor Man's Bible) attributed to him feast day July 14
Bonaventure Island Quebec Canada 2 1/4 mi long 1/4 mi wide in Gulf of St. Lawrence Q 5, picture C 95 gannet C 10

Bonavista (bón a vis ta) name of bay cape district and fishing town on coast of Newfoundland Canada pop. of town 4,000 maps C-69 73

Bonci (bón che) Alessandro (1870-1940) Italian tenor sang with Manhattan and Metropolitan Opera companies New York City after 1910 appeared chiefly in concert

Bond Carrie Jacobs (1862-1946) song writer born Jacksonville Wis. composer of A Perfect Day and other songs of simple style and appealing sentiment which have won great popularity

Bond George Phillips (1825-57) astronomer born Dorchester Mass. succeeded his father William Cranch Bond as director of Harvard College Observatory 1850-63 credited with discovering Hyperion and Saturn's crape ring pioneer in photographic astronomy

Bond Sir Robert (1837-1927) Newfoundland statesman premier 1900-1909 leader of Liberal Opposition retired from public life in 1914 of opposed union with Canada

Bond William Cranch (1789-1868) astronomer born Falmouth (now Portland) Me. father of George P. Bond founder and first director of Harvard College Observatory 1839-59 credited with invention of electrochronograph

Bond led warehouse T 18

Bondfield Margaret (1873-1953) English labor leader first woman Cabinet member born Somerset daughter of a lace maker of American ancestry fought for suffrage and organization of women workers in House of Commons 1923-34 1926-31 secretary to Ministry of Labor 1924 minister of labor 1929-31

Bond in building construction B 304 See also 4: Index Architecture

Bond Interest bearing security issued by a government or a corporation S 398 B 236

books about S 400 credit instrument C 510

financial page lists S 399-400 financing business E 228

government S 398 U 360, V 238 insurance companies hold I 1650, chart I 168

interest & 398 P 144b T 202 investment trusts T 201

mortgage as security S 398 open market operations Federal Reserve Bank F 50

Bondage See in Index Bondi ea
Bone Sir David Williams (born 1874) British novelist and mariner born Glasgow brother of Sir Muriel Bone stories of sea (The Brass-boulder Broken Stowage)

Bone Sir Muriel (1876-1957) British etcher and painter born Glasgow Scotland master in use of dry point official artist on the western front and with the British fleet 1918-18 with British Admiralty 1940-43

Bone (bō) also Bone Aker 1. fortified seaport and manufacturing city abt 80 mi n.e. of Chantant pop. 776 a just south of Bone lie the ruins of Hippo see of St. Augustin apy A 167 A 46

Bone B 225 7; c r B 228 See also 1: Index Skelet n b; ne br ken first aid I 95b p c r I 86a cave n an art. p c r M 63 comp action B 225

diseases rickets V 496 498 growth children C 240a minerals

necessity M 267 F 217 hollow I rds B 156

marrow produces blood cells B 226 d a a B 239

parathyroids affect H 425-6 products B 227

but black C 186 bone las T 116

butters B 372 gelatin G 35

glue C 127 phosphorus P 209

Bone black C 186 Bone china P 403

developed by Josiah Spode the younger P 398

Bonehead also cur p cure P 406a

Bonewet or thoroughwort a perennial herb (*Eupatorium perfoliatum*) of the composite family with stout hairy stem leaves opposite lance shaped and united at base small white flower heads in large clusters leaf from dried plant formerly used for colds and fevers

Bone tarqueuse See in Index Odontolite

Bon festival in Japan J 305

Bong (bong gu) an African antelope (*Procapra capensis*)

price paid for by 200s 2 358

Bongo or Obongo a reddish brown people of Equatorial Africa of medium height and good muscular development women wear metal ornament in upper lip and extend lower lip with wooden plug

Boni cur (boi ur) Marie Rosalie (Karl) (1822-99) French artist B 227-8

paint gas pictures B 227

Bonhomme Noct (bon om nō ei) C 294b

Bonhomme Richard (ré akar) ship of John Paul Jones J 363 picture B 123a

Boniface Saint (680-755) English missionary festival observed June 5 B 228

Christmas trees legend C 294

Boni ace name of Pope John B 228 For list see in Index Pope table

Boniface VIII (1257-1303) pope B 228

University of Rome R 193 Glottis and G 110-11

struggle with Philip IV P 190-1

Boniface IX (died 1404) pope B 228

Bonifacio (bō nō fī chō) Strait of between Sardinia and Corsica map F 425

Bonin (bō nō) Islands Japanese

Onosawara Jima (ō jō sa wa ra ge ma) former Japanese island group in Pacific 536 mi s.e. of Yokohama U 3 s1 mi pop 146 occupied by U S in 1945 under Japanese Peace treaty with Allies effective 1952 B 219s were to be administered by U S pending the placing of the islands under United Nations trusteeship with U S as administering authority map F 16

Bonito (bō nō) a fish related to the tuna T 205

Bonn (bō n) city in Germany pop. 115,394 became capital of Federal Republic of Germany 1949 B 228 1: ps C 68 E 425

Bonn University of at Bonn Germany founded in 1774 by Frederick William III of Prussia a faculty of law medicine philosophy and Roman Catholic and Protestant theology

Bonnafe (bō nā) Edmond (1827-1903) French artist an authority in furniture

Bonnart (bō nā) Pierre (1867-1947) French painter born Paris forced to leave native use of color called a divergent Impressionist also a perfectionist Impressionist

Bonnat (bō nā) Léon (1833-1927) French painter first known for genre and religious paintings but most noted for portraits—realistic powerful warm in color

Bonnet (bō nē) Charles (1720-93) Swiss naturalist philosopher and psychologist studied behavior of ants gave physiological explanation of mental life

Bonnet Mède (died 1718) American pirate former English army officer and respected plantation owner in Barbados bought sloop *Rogue* and became pirate hunted prizes with notorious Edward Teach Pardoned by governor of North Carolina sailed again as *Rogue* Jack captured 1718 and hanged in Charleston S C C 136

Bonnet Mosley M 352

Bonnet rouge See in Index Liberty cap

Bonneville (bō nō) Benjamin Louis Enlals de (1798-1878) U.S. Army officer and explorer born France served in Mexican-Sonora war and Civil War explored in Rocky Mts and California 1831-36 Lake Bonneville named for him Washington Irving wrote about him in *Adventures of Captain Bonneville* I 23

Bonneville Lake extinct glacial lake in Utah C 146

Bonneville salt flats map U 410
Bonneville Dam in Oregon and Washington on Columbia River C 415a O 410 maps C 415b O 418 W 444 pict re D 7 color pict re U 398 See also in Index Dam table fishways D 7 pict re D 7

Bonneville U.S. Administration B 314 415a

Bonny William H See in Index Billy the Kid

Bonny Blue Flag a Confederate flag P 130d color picture F 128

Bonnie Prince Charlie popular name for Charles Edward Stuart grandson of James II of England also called Young Pretender F 410

Bonni (bō nō) Franco (1873-1951) Italian statesman premier 1931-33 retired from public life 1934 after denouncing Fascism in World War II headed Committee of National Liberation in Rome succeeded Badoglio as premier June 1944 resigned June 1945

Bonsels Waldeemar (1841-1932) German

See in Index German n gem go thin then n=French nasal (Jean) zh=French j (je in aure) x=German guttural ch

man author of short stories and books of travel ('Maya the Bee').

Bontemps (*bôn-tâm'*). Arna (born 1902), Negro poet and novelist, born Alexandria, La.; his books for adults: 'Drums at Dusk', 'Black Thunder'; for children: 'You Can't Pet a Possum', 'Sad-Faced Boy', 'Story of the Negro', 'Chariot in the Sky'.

Bontoks, primitive people in Luzon, Philippine Islands P-194

Bonus, something given in addition to what is strictly due, as a payment to employees above their regular wage

Industry: increases production L-145

soldiers' P-140: veto of Calvin Coolidge overridden C-467; of Herbert Hoover H-423

Booby, a large sea bird related to the gannet, so called because of its apparent stupidity and tameness when nesting G-10, picture G-4

Booby traps, disguised mines T-157

Boogie-woogie music, a form of jazz music M-466-7

Bookbinding B-240-1
case binding B-245
commercial, beginnings B-240-1
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end papers B-245
famous binders and their work B-241, picture B-240
medieval book covers B-236, 240
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Book collecting B-246-7

Book credit C-509

Book Exchange, Inc., The United States L-198

Book inventory, or perpetual inventory I-143

Bookkeeping B-229-30, pictures B-229-30
calculating machines C-18b

Book lice, minute insects, generally wingless, of order *Corrodentia*; found in old books and papers, furniture, bedding; they feed on microscopic molds; noninjurious.

Bookmobile, or book bus L-191, pictures L-190, 191, 192

Book of Common Prayer. See in Index Prayer. Book of Common

Book of Kells B-236

'Book of Mormon' M-302

'Book of the Dead' E-286

Bookplates B-247, picture E-388

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Bibliography; Bookbinding; Book-
selling; Engraving and etching; Illustration of books; Libraries; Literature; Literature for children; Manuscripts; Paper; Printing; Publishing; Reading; Reference books; Storytelling; Type; Typog-
raphy
ancient: Babylonia B-231; Egypt B-231, C-458; Greece B-231, 247; Hittites H-385-6; Rome B-231
awards, literary. *See in Index*
Awards
bibliographical description B-140, B-239
binding. *See in Index*
Bookbinding
blind, books for B-206-7
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awards, literary. *See in Index*
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paper P-66-71, pictures P-67-71
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parchment and vellum B-232, 236
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sizes of books B-239
textbooks, modern E-248
title page introduced L-239
typography T-228-30
universities medieval B-237-8

Bookselling B-247-9
ancient Rome and Greece B-247
consignment B-248
early printers as booksellers B-248
France B-238, 248, picture P-83
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Book Week, a week in November designated annually for promotion of the reading and sale of children's books; originally proposed in 1919 by Franklin K. Mathiews, librarian, Boy Scouts of America; first sponsored by the American Booksellers' Association with endorsement of the American Library Association; now backed by these and many other national and local organizations. Headquarters, Children's Book Council, New York City. *See also in Index*
Young Canada's Book Week

Bookworm, a beetle B-107

Boom, of a sailboat B-216. See also in Index
Nautical terms, table

Boomer, or old man, kangaroo K-1

Boomerang B-249, pictures A-481, B-249

Boomer State, a popular name for Oklahoma, coming from Payne's Boomers, a group of men led by David L. Payne, who organized colonies and agitated for the opening of the territory to settlement: O-376

Boondoggle, word coined 1925 by scoutmaster Robert H. Link, Rochester, N. Y., to designate looped cord of plaited leather worn by Boy Scouts as neckerchief slide; in 1935 word applied to wasteful activity on federal relief projects.

Boone, Daniel (1734-1820), pioneer B-250-2, K-23, 24, 34a, U-374, pictures B-250-1
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Cumberland Gap National Historical Park N-33, map N-18
Hall of Fame, table H-249
James Daugherty drawing, picture F-203
Pioneer National Monument N-38a, map N-18
tall tale about F-202

Boone, Iowa, clay-manufacturing and coal-mining center 35 mi. n.w. of Des Moines; extensive agricultural trade; pop. 12,164; map I-214

Boonesboro, Ky. See in Index
Boonsboro

Boone's Trace, later called Wilderness Road R-161

Boonsboro, also Boonesboro, Ky., village on Kentucky River 18 mi. s.e. of Lexington
attacked by Indians B-251
Boone founded B-251

Boost. See in Index
Aviation, table of terms

Boötes (bô-ô'tēz), northern constellation containing Arcturus; near Great Bear, name means "the herdsman"; charts S-376-7, 380

Booth, Ballington (1859-1940), English-American religious leader, born Brighouse, England; son of William Booth: S-33, 35
founded Volunteers of America S-35

Booth, Edwin (1833-93), actor, born Bel Air, Md.; brother of John W. Booth, foremost American tragedian of his day; won great fame also in England, played Shakespeare, notably Hamlet, King Lear, Othello, Richard III, Shylock, and Macbeth
Hall of Fame, table H-249

Booth, Evangeline Cory (1865-1950), English-American religious leader, born London, England, daughter of William Booth; commander in chief of Salvation Army in U. S. 1904-34; general of international Salvation Army forces 1934-39.

Booth, John Wilkes (1838-65), actor, born Hartford Co. Md., brother of Edwin Booth; assassinated President Lincoln April 14, 1865; escaped to Richard H. Garrett's barn, near Fredericksburg, Va.; fatally shot April 26 when soldiers and detectives set fire to barn and surrounded it; died same day; opinion divided whether Booth killed himself or was killed by a soldier's bullet despite order not to fire: L-250

Booth, Maud Ballington (1865-1945), wife of Ballington Booth; born Llimpsfield, Surrey, England S-35

Booth, Shirley (born 1907), actress (stage, motion picture, television, radio), born Shirley Booth Ford in New York City; at age of 12 appeared in 'Mother Carey's Chickens'; other plays 'Three Men on a Horse', 'Philadelphia Story', 'My Sister Eileen'; won several awards for role as Lola Delaney in stage and screen versions of 'Come Back, Little Sheba'.

Booth, William (1829-1912), founder of Salvation Army, born Nottingham, England; father of William B. Booth and Ballington Booth; English minister, author ('In Darkest England and the Way Out', a work offering remedies for pauperism): S-33, picture S-33

Booth, William Bramwell (1856-1929), Salvation Army leader, born Halifax, England; succeeded father, William Booth, as commander in chief of Salvation Army, 1912.

Boothe, Clare. See in Index
Luce, Clare Boothe

Boothia (bo'thi-ə) Gulf of, inlet of Arctic Ocean in n. Canada, map C-68-9

Boothia Peninsula, northernmost peninsula of North American mainland, map C-68-9

Booth-Tucker, Frederick St. George de Latour (1853-1929), commander of Salvation Army in U. S. (1896-1904), organized branch in India 1892; son-in-law of William Booth.

Bootle, England, at the mouth of the Mersey; great docks are part of dock system of Liverpool; pop. 74,302; map B-325

Boots and shoes See in *Index Shoe*
 Bop or bebop form of jazz music
 first became popular 1947

Bopp (bop) Bruno (1891-1967)
 German philologist one of the
 founders of the scientific study of
 languages (Comparative Grammar
 of the Indo-European Languages)

Bora (bōrd) Katharina von (1499-
 1522) wife of Martin Luther L 353

Borac acid See in *Index Boric acid*

Boraginaceae (bōrājīnācē) the
 borage family a large plant group
 consisting mainly of rough haired
 annual or perennial herbs distrib-
 uted over temperate and tropical
 regions Includes forget-me-not
 Virginia cowslip and heliotrope

Borah (bōrā) William Edgar (1856-
 1940) political leader born Fair-
 field Ill U S senator from Idaho
 after 1907 a Republican of inde-
 pendent views brilliant debater
 foe of monopoly partly responsible
 for creation of Department of
 Labor opposed League of Nations
 World Court Versailles Treaty
 defended prohibition as Chairman
 Senate Foreign Relations Com-
 mittee championed Conference for
 Limitation of Armaments
 Statuary Hall See in *Index Statu-*
ary Hall (Idaho) table

Borah Peak highest point in Idaho
 12,663 ft. in the Pahsimero Range
 in Lemhi National Forest a crest
 Idaho named after William L.
 Borah senator from Idaho map
 I 14

Borate a salt of boric acid

Borax a salt (sodium borate
 Na₂B₄O₇) of boric acid and sodium
 B 252 table M 176

Borax test for metals B 252

Breeding use in B 22
 sources B 252 M 255 C 252 D 26

Borchgrevink (bōrkgrēvīk) Car-
 ten E (1864-1934) Norwegian ex-
 plorer born Oslo surveyed in Aus-
 tralia made scientific observations
 in South Seas member of small
 party the first persons to land on
 Antarctic Continent (1895) com-
 manded Southern Cross expedition
 to Antarctica 1899-99

Boréaux (bōrō) Henry (born
 1870) French novelist born
 France member of French Acad-
 emy known for wholesome stories
 of family life ("The Year of Liv-
 ing")

Bordeaux France port near w coast
 pop 238 653 B 252 maps F 259
 L 425

Bordeaux University of established at
 Bordeaux France in 1441 self-
 governing until reign of Francis I
 thereafter under state science let-
 ters law medicine pharmacy

Bordeaux mixture poisonous spray
 S 357

Borden Sir Frederick William (1847-
 1917) Canadian statesman born
 Cornwallis Nova Scotia practiced
 medicine minister of militia and de-
 fence 1898-1911

Borden Gail (1861-74) inventor and
 industrialist born on farm near
 Norwich N.Y. discovered first
 successful process for condensing
 milk (patented 1859) introduced
 to dairy industry sanitary methods
 which have since become law

Borden Sir Robert Laird (1854-
 1937) prime minister of Canada
 B 252-S C 102 picture B 253

Border Patrol of U.S. Immigration
 Service I 49

Borders The territory on both sides
 of boundary between England and
 Scotland

Border territory table D 118

Boré (bōrō) Étienne de (1741-1820)

Francis American sugar planter
 L 322

Bore or caliber of firearms
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 ch. kebores F 80
 machine gun M 11
 rifle F 78 gyroscope principle G 237
 shotgun F 80
 smooth F 79

U.S. Navy guns N 83 84 85 86
 87 88

Boreal tidal T 130 See also in *Index*
Tide

Boreal life real in North America
 V 258 map N 258

Boreas (bōrēas) in Greek mythol-
 ogy god of the north wind A 29

Borecole (bōrkōl) collards or kale
 common names generally applied
 to *Brassica oleracea* var. *botrytis*

also a member of the mustard fam-
 ily The curly leaves widely used
 as vegetable greens L 3

Borelli Giovanni Alfonso (1658-4)
 Italian physicist physiologist and
 astronomer born Naples his The
 Flight of Birds applied principles
 of line hauls to movements of
 animal often regarded as de-
 veloper of parabola paths of comets

Borer See in *Index Borer* and in
 Borer or leaf-miner parasitic H 1 89

Borger Tex. city 47 mi. n. of Amar-
 iloo pop 18,005 petroleum maps
 T 99 L 252

Borghese (bōrgēsē) Giuseppe An-
 tonio (1882-1952) Amer. can
 scholar writer born Sicily to U.S.

1931 professor Italian literature
 University of Chicago 1936-51

author of literary and political
 criticism and history poetry novels

Borghese (bōrgēsē) distinguished
 Italian family originally from Si-
 ena later residing in Rome Camil-
 lo (1850-1871) became Pope Paul
 VI in 1963 and associated family to
 great power Camillo Filippini Lodo-
 vico Prince Borghese (1832-1912)
 was second husband of Pauline
 Bonaparte Napoleon's sister

Borghese (bōrgēsē) museum in Rome
 Italy See in *Index Museums table*

Borini vase picture B 443

Borghese Villa formerly suburban
 estate of Borghese family near
 Porta del Popolo in Rome Italy

Borg a (bōrgā) a powerful family of
 Renaissance Italy B 253

Borgia Caesar (1476-1507) B 253
 Leonardo da Vinci and V 474

Borgia Francis (1510-73) of the
 Spanish Borgia family head of
 Jesuit order B 253

Borgia Isabella (1490-1519)
 duchess of Ferrara B 253

Borghini Gius. (1867-1941) Ameri-
 can sculptor B 253 S 81

Borg Mount Pugh re. general S 295
 pictures S 79 S 305

statues by S 147 picture N 135

Borghini Valon Hannibal (1868-1922)
 Borghini brother of Gius. born

Ogden Utah skilled in horsemanship
 and horsemanship cowboy and
 Indian

Borlucchi Lucera (bōrlūchi) (born 1888)
 Spanish lyric soprano born Valen-

cia made debut in Rome Italy in
 1914 sang with Metropolitan
 (New York City) and Ravinia
 (Chicago) Opera companies re-

tired 1936

Boric acid or boric acid a mild
 antiseptic (H₃BO₃) containing
 boron found in nature and also
 prepared as crystals B 252

Boreopneustic use in F 92

Boreopneustic use in F 92

Boreopneustic use in F 92

Boreopneustic use in F 92

Boreopneustic use in F 92

Boreopneustic use in F 92

Boreopneustic use in F 92

Boreopneustic use in F 92

Boreopneustic use in F 92

I 162 deathwatch beetle B 107
 digger wasps W 53 termite T 74

Oyster drill O 438
 teredo or shipworm C 8

Boring tool T 153 pictograph T 151

Boring (bōring) 111 (1894-1943) king
 of Bulgaria B 249 S 0

Boris Godunov (gōdūnōv) (1551?-
 1605) Russian czar favorite of
 Ivan IV while regent for Ivan's

son Theodore reconquered Siberia
 regained land from Sweden gained
 throne 1598 died a martyr in
 favor of first false Demetrius sub-
 ject of 1843 by Pushkin opera by
 Chaiikov

Chaiikov in opera picture O 393

Bormann Martin (1890-1945) Ger-
 man Nazi Hitler's creator after
 Goering reported missing at end
 of World War II 1946 sentenced to
 death in absentia for war crimes

Born Max (born 1892) Brit. sch. phys-
 icist born Breslau Germany he
 became British subject 1933 Taft
 professor of natural philosophy
 University of Edinburgh 1936-53

retired 1954 and moved to West
 Germany here 1954 Nobel prize
 in physics with Walter Bothe for
 contribution to quantum me-
 chanics

Borneo (bōrnō) Island in Malay
 Archipelago over 290,000 sq. mi.
 pop. about 4,000,000 B 254-6
 maps E 222 A 407 P 18 pictures
 B 254-8

animals B 255 orangutan O 402
 proboscis monkey N 352 picture
 M 351 Wallace's line E 224

children pict. re B 255

climate B 254

people B 254 pictures B 254-6

political divisions B 255

relationships to continent, maps
 A 406-7 411-12

size comparative See in *Index Is-*
lands table

superstitions B 254 E 205

Borneo Indonesian formerly Dutch
 Borneo or Netherlands Borneo the
 w. and e. parts of the Island of

Borneo 207,000 sq. mi. pop 2,000,
 000 B 255 maps L 202 A 407
 pictures B 254 6

Bornholm (bōrnholm) Island of
 Denmark 227 sq. mi. pop 49,194
 D 68 map D 71

Bornite (bōrnīt) also arsenite a
 copper iron sulfide mined in
 Brit. Isles and United States

iridescent color chemical formula
 Cu₅FeS₄ M 262

Born Badur (bōrnbadur) temple in
 Java J 398 picture J 326

Borodin (bōrdōn) Alexander
 (1834-87) Russian composer (in
 Central Asia for orchestra "Prince
 Igor opera symphonies songs
 string quartets) a chemist by pro-
 fession took up music as hobby

Borodino (bōrdōnō) Russian vil-
 lage 80 mi. w. of Moscow scene of
 bloody but indecisive battle (1812)
 between Napoleon and Russians

Boronic chemical element table
 P 151 C 214 M 176 See also in
 Index Doric acid

compounds used in glassmaking
 G 121

electronic structure diagrams A 458
 C 215

Boronic glassware C 125

Borough (bōrō) a municipal corpo-
 ration forming a separate village or
 town or a part of a large city

London L 239

New York City N 228

Borowski (bōrōvskī) Frédéric (born
 1871) American composer born in
 England of Russian parentage

present Chicago Musical College
 1916-20 professor of musicology

Northwestern University; critic and writer on musical subjects.

Borromeo (*bôr-rô-mê-ô*), *Saint Carlo* (1538-84), cardinal and archbishop of Milan, Italy; transformed his diocese from one of license and disorder to model city, one of chief factors in Counter-Reformation in Roman Catholic church; feast day November 4

Borromini (*bôr-rô-mê-nê*), Francesco (1599-1667), Italian architect and sculptor, born Bissone, near Como, Italy; a leading representative of the baroque style; official architect of Rome 1644-55; R-195

Borron, George (1603-51), English traveler, friend of gypsies, author ('The Bible in Spain', 'Lavengro', 'The Romany Rye', 'Wild Wales').

Bors, Sir, one of knights of Round Table R-236

quest for Grail G-1

Borsch, a Russian soup R-264

Borsippa, modern Birs-Nimrud, Iraq, ancient city 15 mi. s.w. of Babylon; sometimes called Babylon II; its patron deity was Nebo

ziggurat P-447

Borts, or borts, small diamonds

used for wire dies W-163

Bor'zoi, or Russian wolfhound, table D-118a

Bosquet, Bernard (1848-1923), English philosopher; lecturer at University College, Oxford; professor St. Andrews University; said, "Logic is the clue to reality, value and freedom" ('Psychology of Moral Self', 'History of Aesthetic').

Bosch (*bôsk*), Hieronymus (or Jerome), van Aeken (1450?-1516), Dutch painter, born 's Hertogenbosch, Netherlands P-25b-c

'Vision of Tondalys' P-25b, color picture P-25d

Bosch, Karl (1874-1940), German chemist; developed process of large-scale production of ammonia for which he was awarded Nobel prize in chemistry 1931 jointly with Dr. Friedrich Bergius; N-241

Bosco (*bôs'kô*), Giovanni Melchior (John), Saint (1515-88), Italian

founder of Salesian order, Roman Catholic monastic society for training of street boys for useful lives; canonized 1934.

Bose (*bôs*), Sir Jagadis Chunder (1858-1937), Hindu physicist, botanist; at Presidency College, Calcutta, India, after 1885; founder Bose Research Institute, Calcutta; noted for theory that plants have nervous organizations ('Plant Response', 'Motor Mechanism of Plants').

Bosio (*bôs-yô*), Francois Joseph (1769-1845), French court sculptor of neoclassic school; typical of his style are bust of Josephine in Dijon and bronze equestrian statue of Louis XIV in Paris.

Bosnia (*bôs'ni-a*) and Herzegovina (*hêrt-sê-yô-vê-nâ*), part of Yugoslavia; nearly 20,000 sq. mi.; pop. 2,845,486; B-256, Y-346-8, maps B-23, A-497, E-425. See also in Index Yugoslavia

people B-256

Sarajevo, city well, picture B-25

World War I, outbreak W-215

Bosporus (*bôs-pô-rûs*), or Bosphorus, strait 18 mi. long between Sea of Marmara and Black Sea B-256, maps T-215, B-204, E-417

World War I W-230

Bos'si (*bôs'sê*), Marco Enrico (1861-1925), Italian organist and composer ('Paradise Lost' and 'Song of Songs', cantatas; operas; organ and chamber music).

Bosler (*bô'slur*, also *bô-sêr'*) City, La., town on Red River opposite Shreveport; pop. 15,470; cattle, cotton; oil center; Barksdale Air Force Base nearby; map L-330

Bossuet (*bôs-wê'*), Jacques Bénigne (1627-1704), French preacher; bishop of Meaux and tutor to son of Louis XIV; considered one of world's greatest pulpit orators.

Boston, Mass., state capital; pop. 801,444; B-257-61, maps U-253, inset M-132, pictures B-257-9

Christian Science, Mother Church of, picture E-233

early musical center M-466

education B-258, 260; first public

high school E-242

Faneuil Hall B-260, A-319, picture

B-259

Federal Reserve Bank (1st) and

district, map F-49

fishing port F-111

government M-451

harbor, spring tide T-130

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history B-260-1

Winthrop founded W-161

early trade S-161

harbor in 1630 picture U-369

first newspapers N-188

Stamp Act, reading of, picture R-121

Boston Massacre R-125

Boston Tea Party R-122

Revere's ride R-119, B-260

Bunker Hill battle B-351-2, map

B-351; Monument B-260, picture

B-259

fire, great B-261

juvenile court J-368

Museum of Fine Arts See also in

Index Museums, table

Bodhisattva Avalokitesvara, color

picture S-72

Copley's 'Paul Revere' P-31, color

picture P-30

Wu Chen's 'Bamboo in the Wind'

D-140f, picture D-140

Old Ironsides B-260, picture N-91

Old State House B-260, pictures

B-259, D-33

playgrounds P-86a

police strike and Coolidge C-466

State House (State Capitol) B-257,

258, picture M-135

subway S-430

waterworks, first in America W-74

Boston bluefish P-364

Boston College, at Chestnut Hill, Mass.;

Roman Catholic; for men; char-

tered 1863; arts and sciences, busi-

ness administration, education, law,

nursing, philosophy, social work,

theology; graduate school.

Boston Common, famous park B-258,

P-86a

Boston ivy, or Japanese ivy I-284

Boston Massacre R-125

Adams, John A-13

Hancock, John H-254

Boston Mountains, a southern range

of the Ozarks, in n.w. Arkansas

O-440, maps A-366, U-274

Boston Navy Yard, or Charlestown

Navy Yard, at Boston, Mass.; estab-

lished 1800; builds and repairs aux-

iliaries and destroyers, also repairs

cruisers; B-260

Boston Port Bill, one of the Coercive

Acts passed by British Parliament

(1774) after Boston Tea Party;

closed port, removed seat of gov-

ernment to Salem and demanded

reparation; R-122

Boston Post Road, early American

highway between New York City

and Boston R-161, map R-159

Boston Public Library B-258, picture

B-258

paintings; by Abbey, pictures A-293-

4; by Sargent S-46, picture P-419

Boston Tea Party R-122, picture R-122

Adams, Samuel, organizes A-17

Revere, Paul R-119

Boston terrier, color picture D-115,

table D-119

Boston University, at Boston, Mass.; chartered 1869; liberal arts, business administration, education, industrial technology, law, medicine, music, nursing, physical education, practical arts and letters, public relations and communication, social work, theology; graduate school.

Bostwick, Arthur Elmore (1860-1942), librarian and writer, born Litchfield, Conn.; librarian, St. Louis Public Library 1909-38, later associate librarian; author of books and articles on library work, science, and literature

Boswell (*bôs-wê'l*), James (1740-95), Scottish biographer and diarist ('Boswell's London Journal'), picture J-361

friend and biographer of Dr. Johnson J-360, 361-2, L-98c

Bosworth Field, Leicestershire, Eng-

land site of final battle of Wars of

the Roses (1485) R-151

Botanical garden B-261-2, picture

B-261

first in America P-140

Botany, the study of plant life B-262-5, picture B-263, Reference-Outline B-263-5. See also in Index

Plants; and chief subjects listed

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seaweed S-94-5, pictures S-94

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bacteria B-12-15, pictures B-12-15

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bulbs, tubers, and rootstocks B-348,

picture B-348

cell as life unit C-159-61, pictures

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work L-254-5; principles B-152

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color pictures E-212, Reference-

Outline B-264

economic, Reference-Outline B-264

ferns F-52-4, pictures F-52-4

flowerless plants, or thallophytes

P-288-9, Reference-Outline B-264

flowers F-168-87, pictures F-168,

181-7, color pictures F-169-80

fruits F-306; how developed F-186

fungi F-316, pictures F-316

heredity, Mendel's laws H-344, dia-

grams H-345

history B-262

leaves L-151-4, pictures L-151-2,

color picture L-153

liverworts L-278

morphology B-262, A-239, Reference-

Outline B-263-4

mosses M-404-6, pictures M-405

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experiments for studying P-298-

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reproduction B-148, color picture

B-149, diagrams H-346, Reference-

Outline B-264

roots R-226-7, pictures R-226-7

seeds S-96-8, pictures S-97

spores S-355-6, pictures S-356

trees T-178-85, pictures T-179-84

Botany Bay, inlet on e. coast of Aus-

tralia, near Sydney; so named by

Captain Cook (1770), because of

richness of vegetation; map, inset

A-489

Botfly, fly whose larvae live under

the skin of animals F-189, I-157

Botha (*bô'tā*), Louis (1862-1919),

South African military leader and

statesman, born near Greytown, Na-

tal; in 1900 became commander in

chief of Boer forces in Boer War;

- statesman, born Paris; in chamber of deputies almost continuously after 1888; six times in Cabinet; premier 1895-96; helped draft Covenant of League of Nations and strong advocate of League; won Nobel peace prize, 1920.
- Bourgeois** (*bûr-jois*'), a type T-228
- 'Bourgeois Gentilhomme, Le'** (*lû bor-zhûr' zhân-tê-yôm'*) (The Tradesman Turned Gentleman), comedy by Molière (1670); M. Jourdain, common elderly tradesman suddenly wealthy, makes himself ridiculous by trying to acquire education and manners of a courtier.
- Bourgeoisie** (*bor-zhûr-zê'*), French term applied to people of the middle class C-426
- Bourgeois, Marguerite** (1620-1700), Canadian Roman Catholic nun, born Troyes, France; 1653 emigrated to Canada and founded at Montreal a religious order, the Congregation of Notre Dame
- Bourges** (*borzh*), France, historic city, manufacturing and trade center 125 mi. s. of Paris; pop. 41,597; magnificent cathedral; maps F-270, E-425
- Bourget** (*bûr-zhé'*), Paul Charles Joseph (1852-1935), French novelist, dramatist, and critic; keen psychological analyst ('The Disciple'; 'The Night Cometh'); F-289
- Bourmont** (*bûr-môn'*), Étienne Venard, sieur de (1680?-1730?), French explorer M-326
- Bourgogne**, France. See in *Index* Burgundy
- Bourinot** (*bo-rê-nô'*), Sir John George (1837-1902), Canadian historian and writer on political science ('Manual of Constitutional History'; 'Canada under British Rule')
- Bourne**, Randolph Silliman (1886-1918), literary critic and essayist born Bloomfield N. J.; a pacifist during World War I ('Youth and Life'; 'Education and Living'; 'The History of a Literary Radical'; compiler, 'Towards an Enduring Peace')
- Bournemouth** (*börn-mûth*), England, watering place and winter resort 22 mi. s.w. of Southampton; pop. 144,726; map B-325
- Bourse** (*bors*), in Europe, a stock exchange or money market; from medieval Latin *burza* ('purse') Paris, map P-83a
- Boutet de Monvel** (*bo-tê' dû môh-rêl'*), Louis Maurice (1851-1913), French genre and portrait painter and illustrator, born Orléans; did series of illustrations depicting the life of Joan of Arc; planned murals on this subject for church at Domrémy, but only one was completed (now in Art Institute of Chicago) as illustrator L-208, L-270
- Bouts** (*bouts*), Dirk, or Dierick (1420?-75), Flemish painter, worked chiefly in Louvain; introduced new relations of light and color; master at portraying facial expression ('Entombment'; 'Pieta'; 'Moses and the Burning Bush')
- Boutwell**, George Sewall (1818-1905), statesman, born Brookline, Mass.; first U. S. commissioner of internal revenue 1862; in Congress 1863-69; secretary of the treasury 1869-73; U. S. senator 1873-77
- Bouvet de Lozier** (*bo-tê' dû lôz-zê'*), Jean Baptiste Charles (1705-88), French explorer under French East India Co.; first to reach Antarctic ice pack; discovered Bouvet Island 1739
- Bouvet Island**, in Antarctica; discovered 1739 by Bouvet de Lozier;
- made dependency of Norway 1930; map A-259, table P-349
- Bouvier des Flanders**, a working dog, table D-118a
- Bourvins** (*bo-tên'*), France, village 7 mi. s.e. of Lille; scene of victory of Philip Augustus of France over Otto IV of Germany (1214)
- Bovidae** (*bô-ti-dê'*), family of hollow-horned ruminants including oxen, goats, sheep antelopes.
- Bovines** (*bô-rins*), cattle C-141. See also in *Index* Cattle
- Bow** (*bô*), district of London, England
- Bow** (*bou*), of ship. See in *Index* Nautical terms, table
- Bow** (*bô*), of violin V-476
- Bow and arrow** A-302-3
- arrowheads**: how Indians made, picture I-91
- bow drill**, pictograph T-151, picture F-73
- fishing with**, picture S-261
- Greek, color picture** S-27: Odysseus, picture O-344
- how to make** A-302
- Hundred Years' War** H-445, 446, pictures H-445, 447
- invention** M-66
- types of bows** A-303: yew Y-339
- Bow and beam bearings**, in navigation N-77
- Bow Church**, or St. Mary-le-Bow, London, rebuilt by Sir Christopher Wren 1670-80, tower is one of his best works L-301
- Bow compass**, used in mechanical drawing M-157c, pictures M-157b, d
- Bow ditch** (*bou'ditch*), Nathaniel (1773-1835), astronomer and mathematician, born Salem, Mass.; at 17 taught himself Latin in order to read Newton's 'Principia'; acquired practical knowledge of navigation as supercargo and master on merchant ships; famous for his book 'The New American Practical Navigator', published 1802, which after many revisions is still the standard authority of U. S. Navy.
- Bowdoin** (*bô'dîn*), James (1726-90), statesman born Boston; elected to constitutional convention of 1779; governor of Massachusetts 1785-87; suppressed Shays' Rebellion; Bowdoin College named for him; first president of the American Academy of Arts and Sciences.
- Bowdoin College**, at Brunswick, Me.; for men; incorporated 1794; arts and sciences
- Hawthorne** at H-294
- Longfellow** at L-309
- Bow drill**, pictograph T-151, picture F-73
- Bow'ell**, Sir Mackenzie (1823-1917), Canadian statesman, in Dominion House of Commons 1867-96, premier 1891-96, Conservative leader in senate 1896-1906.
- Bowen**, Elizabeth (born 1899), Anglo-Irish writer, born Dublin; depicts upper middle class; style delicate, subtle, penetrating (novels—'The Hotel', 'The Death of the Heart', 'The House in Paris', 'Heat of the Day'; short stories—'Ivy Grippled the Steps, and Other Stories'; family history—'Bowen's Court')
- Bowen**, Ira Sprague (born 1898), astronomer, born Seneca Falls, N.Y.; authority on nebular spectra; professor physics California Institute of Technology 1931-45; became director Mount Wilson Observatory 1946; director Mount Wilson and Palomar Observatories since 1945.
- Bower bird**, of Australia B-171
- Bowers**, Claude Gernade (born 1878), diplomat and historian, born Westfield, Ind.; ambassador to Spain 1933-39; ambassador to Chile since 1939 ('Tragic Era'; 'Jefferson and Hamilton'; 'Jefferson in Power'; 'The Young Jefferson, 1743-1789').
- Bowery**, New York City N-218
- origin of name** S-434
- Bowfin** (*bô'fin*), a mudfish, fierce and voracious, found in fresh waters of Canada and United States M-444, 445
- related to gar** F-108
- Bowhead**, or Greenland right whale, a species of right whale, *Balaena mysticetus*, found in polar seas; length 50 to 65 ft.; head is one-third of total length; jaw highly arched; source of whale bone, oil.
- Bowie** (*bô'i*), James (1799-1836), pioneer and soldier, born Burke County, Ga.; settled at San Antonio, Tex. 1828; became a Mexican citizen 1830, sided with the Americans in struggle against the Mexican government; captain of revolutionary forces at Nacogdoches 1832; colonel in 1835 campaign killed while defending Alamo; T-94
- Bowie**, William (1872-1940?), engineer and geodesist, born Annapolis Junction, Md.; chief of Division of Geodesy, U. S. Coast and Geodetic Survey; authority on earth's crust, especially isostasy.
- Bowie knife** T-94
- Bowler**, a low-crowned, stiff-brimmed felt hat; designed by William Bowler, an English hatter, in 1836; called 'billycock' for a time, after its sponsor, William Coke; replaced the top hat in fashion. See also in *Index* Derby hat
- Bowles**, Chester (born 1901), government official, born Springfield, Mass.; head Office of Price Administration 1943-46; director Office of Economic Stabilization 1946; member commission for UNESCO and consultant to UN Appeal for Children 1946-47; governor of Connecticut 1948-50; ambassador to India 1951-53; author of 'Tomorrow without Fear' and 'Ambassador's Report'.
- Bowles**, Samuel (1826-78), journalist, born Springfield, Mass.; editor *Springfield Republican*, which was founded by his father, Samuel Bowles (1797-1851); active in politics and early champion of woman suffrage; succeeded by his son Samuel Bowles (1851-1915).
- Bowl games**, in football F-230
- Bowlie** (*bô'lin*), a knot K-61, pictures K-60, 61
- Bowling**
- American game** B-266, pictures E-266
- cricket** C-511-12
- Bowling Green, Ky.**, industrial city on Barren River, about 100 miles s.w. of Louisville; pop. 18,347; Western Kentucky State College and Bowling Green College of Commerce; trade in horses, mules, hogs; shipping point for rock asphalt, white oolitic limestone; manufactures cut stone, evaporated milk, tobacco products; strategic point during Civil War; maps K-30, U-253
- Bowling Green, Ohio**, city 20 mi. s.w. of Toledo; pop. 12,005; farming; tomato catsup, hydraulic hoists; airport; Bowling Green State University; map O-356
- Bowling Green**, small triangular park in New York City N-218
- in Jackson's time**, picture U-376
- Bowling Green State University**, at Bowling Green, Ohio; state control; founded 1910; arts and sciences,

ter, scholarship, and service; generally held at a college or university and lasts at least five days; program features the actual operation of government and includes a variety of extracurricular activities; headquarters at Indianapolis, Ind.; two juniors from each Boys State are chosen to attend Boys Nation, held annually in Washington, D.C., for the study of federal government.

Oklahoma meeting, picture J-368b

Boys Town, Neb., home for boys, 10 mi. w. of Omaha incorporated as a village in 1936; pop. (1950 census), 975; started and managed by a Roman Catholic priest, Father Flanagan, who was succeeded by Msgr. Nicholas H. Wegner (born 1898) Sept. 1948; supported by private contributions; picture N-105. See also in *Index* Flanagan, Edward Joseph

Boz (bōz), pen name sometimes used by Charles Dickens D-84a

Bozcaada, island, Turkey. See in *Index* Tenedos

Bozeman (bōz'mān), Mont city 75 mi. s.e. of Butte; pop. 11,325; food processing, forest products; Montana State College: M-378, maps M-374, U-252

Bozen, Italy. See in *Index* Bolzano

Bozzaris (bōz'sū-rēs or bō-zār'is), Marco (1788?-1823), the "Leonidas of modern Greece," hero of Greek war of independence; killed at Missolonghi, as told in Fitz-Greene Halleck's poem "Marco Bozzaris".

'Brabangonne, La' (brā-bān'son'), Belgian national air N-41

Brabant (brā'bānt, French brā-bān'), medieval duchy of Netherlands; now divided into North Brabant (Netherlands) and Antwerp and South Brabant (Belgium)

colors used in flag of Belgium F-136b

Bracco (brāk'kō), Roberto (1861-1943), Italian dramatist; known for psychological plays ("The Little Saint"; "Phantassms"): D-133

Brace. See in *Index* Nautical terms, table

Brace, a leverage tool T-150, pictograph T-151

Brachial muscle, picture M-454

Brachiopoda (brā-kī-ōp'ō-dā), or lamp shells, bivalve worms S-139b

Cambrian times G-59, picture P-406a

classified, *Reference-Outline Z-364*

place in "family tree" of animal kingdom, picture A-251

Brachiosaurus (brā-kī-ō-sō'rūs), prehistoric reptile R-113

Brachycephaly (brāk-i-sēf'ā-lī) (broad-headedness, or short-headedness), in ethnology R-21, picture R-23

Brachycome (brā-kīl'ō-mē), a genus of plants native to Australia. See in *Index* Swan River daisy

Bracken, a fern F-53, picture F-54

Brackenridge, Hugh Henry (1748-1816), American jurist and writer, born in Scotland; emigrated to Pennsylvania; classmate of James Madison at Princeton; chaplain in Revolutionary War army; author of satire, "Modern Chivalry": A-226b

Bracket, in architecture. See in *Index* Architecture, table of terms

Bracket fungi, picture N-50

Brackman, Robert (born 1898), American painter, born Odessa, Russia; taught at New York Art Students League after 1933; noted for finely composed figure studies and sensitive, appealing portraits; excellent technique, soft colors.

Bract (brakt), the small, sometimes scabrid, leaves in a flower cluster, rarely noticed. When they develop

into large leaves they are strikingly visible: F-184

Bradbury, John, Scottish naturalist; during 1810-11 traveled up the Missouri River: N-293

Braddock, Edward (1695?-1755), British general, defeated and slain during French and Indian War F-285

Daniel Boone accompanies B-250

Washington aide-de-camp to W-18

Braddock, James J. (born 1905), boxer, born North Bergen, N. J. heavyweight champion B-272, table B-272

Braddock, Pa. steel-manufacturing borough on Monongahela River 10 mi. s.e. of Pittsburgh; pop. 16,488; scene of Braddock's defeat: map, inset P-132

Braddon, Mary Elizabeth (Mrs John Maxwell) (1837-1915), British novelist, born London; stories lurid and sensational; known for "Lady Audley's Secret".

Bradenton, Fla., city 13 mi. s.e. of St. Petersburg, on Manatee River; pop. 13,604; airport: map F-159

Bradford, Andrew (1686-1742), American printer and publisher; published in 1719 the first newspaper in Pennsylvania, *American Weekly Mercury*; published in 1741 the first magazine in America, *American Magazine*; served a prison term for printing essays criticizing the Provincial Council: M-30

Bradford, Gamaliel (1863-1932), man of letters, born Boston, Mass.; noted for vivid and searching character portraits or "psychographs" ("American Portraits"; "Damaged Souls"; "Darwin"; "D. L. Moody—A Worker in Souls"; "As God Made Them; Portraits of Some Nineteenth-Century Americans").

Bradford, Roark (1896-1948), author, born Lauderdale County, Tenn.; journalist in Atlanta and New Orleans until 1926; short stories and novels of Negro life; "Child of God" won O. Henry Memorial Award (1927); "Ol' Man Adam an' His Chillun", Bible tales, inspired Marc Connelly's play "The Green Pastures"; "How Come Christmas; a Modern Morality"; "John Henry", a gripping popular novel.

Bradford, William (1590-1657), American colonial governor and historian; born Austerfield, Yorkshire, England; joined Separatists at age of 17; imprisoned for attempt to leave England, but finally reached Holland; sailed on *Mayflower*; for 30 years governor of Plymouth Colony, whose success was due chiefly to him: P-325

writings A-224; quoted M-147

Bradford, William (1663-1752), American printer and newspaper publisher, born Leicester, England; set up first printing press in Philadelphia in 1682; established (1725) the *Gazette*, first newspaper published in New York.

Bradford, England, city in Yorkshire, 30 mi. n.e. of Manchester; pop. 292,394; woolen mills; municipal ownership of markets, waterworks, street railways: map B-325

Bradford, Pa., industrial and railroad city 65 mi. s. of Buffalo, N.Y.; pop. 17,354; in oil and natural gas fields; paper boxes, cutlery, furniture, brick: map P-132

Bradley, Francis Herbert (1846-1924), English philosopher, born London; made valuable contribution to absolute idealism ("Ethical Studies"; "Appearance and Reality"; "Collected Essays").

Bradley, James (1693-1762), English astronomer; discovered aberration of light, demonstrated nutation of earth's axis; became astronomer royal 1742: A-444

Bradley, Katherine Harris. See in *Index* Field, Michael

Bradley, Omar Nelson (born 1893), U.S. Army officer, born Clark, Mo.; commanded victorious drive of U.S. 2d Corps into Bizerte, Tunisia 1943; senior commander U.S. ground forces in Europe 1944-45; administrator of veterans' affairs 1945-47; U.S. Army chief of staff 1948-49; chairman of the joint chiefs of staff 1949-53; made general (5-star) of the Army 1950: T-200, pictures E-287a, W-271

Bradley University, at Peoria, Ill.; founded 1897; liberal arts, commerce, education, engineering, fine and applied arts, horology, industrial arts; graduate division.

Bradstreet, Anne (1612?-72), American poet, born Northampton, England; wife of Simon Bradstreet; first woman writer in American Colonies; idolized by her contemporaries; "Contemplations" is considered her best poem: A-225

Bradstreet, Simon (1603-97), colonial governor of Massachusetts (1679-86, 1689-92); born Lincolnshire, England; husband of Anne Bradstreet; generally popular, but opposed by majority of colonists for the mildness and toleration he displayed during the first witchcraft persecutions.

Brady, Cyrus Townsend (1861-1920), American clergyman and author, born Allegheny, Pa. ("American Fights and Fighters"; "Under Tops'ls and Tents").

Brady, Matthew B. (1823?-96), photographer, born Warren County, N. Y.; during Civil War followed Union army in campaigns and made photographs; developed plates in wagon fitted as darkroom

examples of work, picture N-92

Brady, a Brahman-Herford hybrid C-146, picture C-144

Braga (brā'gā), Theophilo (1843-1921), first president of the Portuguese republic 1910-11; poet, scholar, and professor.

Braga, Portugal, ancient capital of Lusitania; pop. 32,153; archbishop of Braga is Portuguese primate; thousands make annual pilgrimage to the Church of Bom Jesus do Monte: map E-425

Braganza, or Bragança (brā-gān'sā). House of, the reigning family of Portugal 1640-1910, and of Brazil 1822-39.

Braddon, Claude (Fayette) (1866-1946), architect, born Oberlin, Ohio; designed railroad stations, stage productions; wrote on architecture and theosophy.

Bragg, Braxton (1817-76), Confederate general, born Warren County, N.C.; brother of Thomas Bragg; served in Seminole and Mexican wars; defeated Rosecrans at Chickamauga; defeated by Grant at Chattanooga: C-336

Missionary Ridge defeat C-199

Murfreesboro F-283

Bragg, Edward Stuyvesant (1827-1912), congressman, born Unadilla, N. Y.; Union brigadier general in Civil War; in Congress eight years; seconded Cleveland's nomination (1884), saying, "We love him for the enemies he has made."

Bragg, Thomas (1810-72), lawyer and statesman, born Warrenton, N.C.; brother of Braxton Bragg; gover-

Branle (*brän'l*), given name *brawl* by English, name of several dances of French origin popular in 16th and 17th century France and England; differs with locality but typically two-beat round dance originally sung by dancers; name from French *branler* ("to shake").

Brandy (*brän-lé'*), Édouard (1844-1940), French scientist, inventor of coherer for radio, one of the first successful devices used as a detector of radio signals.

Brannan, Charles Franklin (born 1903), lawyer and government official, born Denver, Colo., U. S. Dept. of Agriculture regional attorney 1937-41, assistant secretary 1944-48, secretary 1948-53.

Brant, Joseph (Thayendanegea) (1742-1807), Mohawk Indian chief; educated Eleazar Wheelock's Indian school; lifelong member Episcopal church; translated English Prayer Book into Mohawk language; aided British in Revolutionary War (Cherry Valley Massacre) but after the war strove for peace between colonists and Indian tribes.

Brant, a kind of goose G-140

Brantford, Ontario, Canada; city 60 mi. s.w. of Toronto on Grand River; pop. 36,727; machinery, clothing; named for Joseph Brant; here Alexander Graham Bell perfected telephone; map, inset C-68

Branting, Hjalmar (1860-1925), first Socialist prime minister of Sweden 1920, again 1921; Nobel peace prize 1921; leading advocate Wilson peace program and League of Nations.

Braque (*bräk*), Georges (born 1881), French painter; with Picasso, founder and chief exponent of cubism

'Interior with Table' P-23a-b, color picture P-23a

Bras d'Or (*brä dö'r*) lakes, on Cape Breton Island C-118, map C-73

Brasenose College, Oxford University, England O-434, picture O-433

Brashear, John Alfred (1840-1920), astronomer and manufacturer, born Brownsville, Pa.; constructed and manufactured instruments of great importance to astronomy and physics.

Brasov (*brä-shöv'*), Rumania, also Kronstadt, city 85 mi. n.w. of Bucharest; pop. 82,984; commanded by Schlossberg citadel; "Black Church" (14th century); metal and wood products: maps B-23, E-417

Brass, an alloy of copper and zinc B-285-7, A-173, Z-351, pictures B-285-6

ancient use Z-351, P-257

artistic uses B-286-7, M-178, pictures B-285-6, E-337

industrial uses B-285-7, C-473

manufacturing processes B-286-7

medieval use M-177, B-286

metalworking M-177, 178-9; American colonial, picture M-178

paint P-41

pins P-257

Brass band B-46b

Brasses, a group of musical instruments O-405, M-472, H-426-7, pictures M-471, H-427

band B-46a

range of, diagram M-468b

Brassicaceae (*bräs-i-kä'sé-é*), or Cruciferae (*kry-sif'er-é*), mustard family C-1-2

Brasstown Bald Mountain, n. Georgia; highest point in state (4784 ft.).

Bratlanu (*brä-ti-ä'ng*), family of powerful Rumanian political leaders, including Ion C. (1821-91), premier 1876-88; Ion (1864-1927), who

dominated Rumanian affairs most of life, practical dictator after 1922; Vintila (1867-1930), minister of finance 1922-26, premier 1927-28.

Bratislava (*brä'té-slä-vä*), formerly Pressburg, Czechoslovakia, trade and industrial city, capital of Slovakia; on Danube River 35 mi. e. of Vienna; pop. 171,362; capital of Hungary 1541-1784: maps G-88, C-535, E-425

Hungary cedes "bridgehead" C-536

Treaty of Pressburg. See in Index Treaties, table

Brattleboro, Windham County, Vt. on Connecticut River, 57 mi. s.e. of Rutland; pop. of township, 11,522; winter resort center. chartered 1753: V-460, map V-457

Brauchitsch (*brouk'ich*), Walther von (1881-1948), German general; commander in chief World War II until removed by Hitler 1941; interned by British Aug. 1945.

Braun, Eva Anna Paula (1912-45?), wife of Adolf Hitler, believed to have committed suicide with him: H-385

Braun, Karl Ferdinand (1850-1919), German physicist, born Fulda; invented (1897) a cathode-ray tube known as Braun tube, shared 1909 Nobel prize in physics with Marconi for work in wireless telegraphy

Braun, Werner von. See in Index Von Braun, Werner

Braunschweig, Germany. See in Index Brunswick

Brauner, Adrian. See in Index Brouwer

Brave money, venture capital I-146

Brawl, dance. See in Index Branle

Brawley, Calif., city in Imperial Valley 95 mi. e. of San Diego; pop. 11,922; shipping point for fruit and vegetables; livestock feeding, produce packing, alfalfa dehydration: maps C-35, U-252

Braxton, Carter (1736-97), signer of Declaration of Independence; born Newington, Va.; delegate from Virginia to Continental Congress

signature reproduced D-37

Bray, Charles (1811-84), English philosopher, born Coventry, England ("The Education of the Feelings"; "The Philosophy of Necessity") influence on George Eliot E-330

Bray, Thomas (1656-1730), English clergyman, philanthropist, writer; active in religious, educational, other benevolent works: L-184, 186

Braz, suburb of São Paulo, Brazil, picture S-43b

Brazil (*brä-sil'*) (officially United States of Brazil), republic of South America; 3,286,000 sq. mi.; pop. 52,645,479; cap. Rio de Janeiro: B-287-94, maps B-288, S-252-3, pictures B-287, 289-93, Reference-Outline S-279

agriculture B-290, 291, 292

Amazon River basin T-184-6, map A-184, pictures A-185

barter, picture A-185

Christmas C-296

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Rio de Janeiro R-154-5, picture R-154

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Roosevelt, Theodore, explorations by R-224

shelter B-290, 291, pictures A-185, B-287

trade B-292-3, 294. See also in Index Trade, table

transportation B-293, picture A-185

Antas River and Florianopolis bridges. See in Index Bridge, table

Brazilian cotton, or kidney cotton C-498

Brazilian Highlands B-287-8, S-271-2, 259, map S-256

Brazil nut, or pará nut N-316

Brazilwood, or dyewood, product of several species, especially Pernambuco wood (*Caesalpinia echinata*); wood is ground to sawdust, then treated with water or alcohol to release coloring matter: B-293

Brazing solder A-173

Brasos (*brä'sós*) River, e.-central Tex.; flows s.e. 950 mi. to Gulf of Mexico; navigable about 200 mi.: maps T-78, U-279

Brazzaville (*brä-zä-vél'*), capital of Middle Congo and of French Equatorial Africa; river port on Stanley Pool of Congo River; connected by railroad with Pointe Noire on the coast; pop. 63,023; map A-47

Bread B-294-8, pictures B-294-7

bakery production B-295-7: air conditioning A-77

baking powder B-16-19

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colloidal texture C-385

consumer protection B-298

corn: pioneers P-263

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farmer to consumer, diagram B-297

flour F-165-7, pictures F-165-7

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Greek clay oven, picture G-192

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Pompeian and Herculanean bakeries P-367

pounds per bushel of flour F-167

prepared doughs and mixes B-295

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toasted, starch changed D-77

unleavened bread B-295: ceremonial use P-94

vitamins B-297-8

wheat W-115, 118

- whole wheat or graham F 167
B 235 food value B 297-8
yeast Y 336
- Bread and Butter State** popular name sometimes given to Minnesota
- Breadfruit** tree of Pacific Islands B 299
- Bread millet** or *proso millet* M 235
- Bread bone fever** M 402
- Breakeer house** at coal mine M 270
- C 565 766 pictures C 368
- Breakers** in coal mining M 270
- Breakers** in glassmaking G 122
- Breakfast cereals** B 299 400
- Break rolls** in flour milling F 166 picture F 167
- Breakspoke Nicholas** See in Index
- Adrian IV**
- Breakwater** a solid barrier built out into sea or lake to protect a harbor from strong waves differs from jetty in that purpose is chiefly protection while purpose of jetty is primarily to direct course of stream and force it to carry its sediment into deep water H 264 See also in Index Jetty
- Bream** name given to several species of both fresh and salt water fish in different localities In fresh water the name is applied to members of the sunfish and roach families Salt water breams are usually members of the percy family
- Breamy David** (1745-90) furrier and statesman born Spring Grove N J chief justice of Supreme Court of N J delegate to Constitutional Convention on signed United States Constitution
- Breathbone** B 191 pictures S 192 color picture P 240
- Breasted** (*breasted*) James Henry (1865-1935) Of entomologist and historian one of greatest authorities on Egypt born Pockford III professor Egyptology and Oriental history chairman Department of Oriental Language and director Oriental Institute University of Chicago conducted archaeological expeditions in Egypt Mesopotamia Palestine Persia (A History of Egypt Ancient Times Conquest of Civilization)
- Breast stroke** in swimming S 473 pictures S 472
- Breast wheel** a water wheel W 68 picture W 68
- Breath hold** in R 117
- Breathing** R 117-18 pictures R 117 See also in Index Respiration
- Brebut** (*brébut*) saint Jean de (1533-1642) Canadian Jesuit missionary and martyr born Comor sur Vire France went to Canada with Champlain 1625 worked among Huron Indians 1636-29 and 1633-49 tortured and murdered by Iroquois canonized 1930
- Brechea** See in Index Conglomerate rock
- Breck Samuel** (1771-1869) patriot son of a prominent Boston family adopted Philadelphia as his native city bitter opponent of slavery served 1817-21 in Pennsylvania senate
- Breckinridge John Cabell** (1801-75) political leader and soldier born near Lexington Ky vice president under Buchanan Confederate general in Civil War and secretary of war in Confederacy
- Jefferson Davis** and D 22
- Bred** present clausal cand date D 125
- Breda** (*bréda*) Netherlands town 25 mi se of Rotterdam pop B 294 as frontier fortress repeatedly taken by Spanish and French residence of Charles II during exile maps B 111 E 424
- Breeches** a garment D 145 147
- Breeches Bible** B 137
- Breeches buoy** a lowering device L 225 picture L 226
- Breech loading gun** F 79-80 pictures F 78 77 A 400
- Breeders associations**
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Bureau of Animal Industry U 364
cattle dairy cows C 144 145 pic
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ray that I breed and t p 64
sheep B 137 8 W 193 A 63 pictures
A 62 S 137
- Breeding plant** F 305 5 B 262 See also I Red Plant improvement
- Breeds** a H near Bunker H B 351
- Breese** a W W 150 d Jams W 151
- Brigs** (b g) River also River
a German a s ure of Danube
P ver D 15
- Brett Gregory** (born 1909) American physicist born Russia moved to U S 1915 studies of atmosphere he led to development of defense work 1940-45 professor of physics Yale University since 1947 R 28
- Brettenfeld** (*brétfeld*) Germany 11466 5 mi n of Leipzig Sued sh
victories 1631 1642 in Thirty Years War
Gustavus Adolphus at G 234
- Bremen** (*brém*) German brd m
small city in Germany pop 558
819 B 300 maps G 88 D 424
- Bremen** German seaport in state of Bremen on Weser River 46 mi from its mouth pop 444 649
B 300 maps G 88 E 416 424
education E 263
Hanseatic League H 261
- Bremen Town Musicians** The story written by the Brothers Grimm S 466b
- Bremer** (*brémér*) Fredrika (1801-65) Swedish novelist and women's rights advocate (The Proserpina Daughters The H Fam y)
- Bremershaven** (*brémérshavn*) German seaport for Bremen on Weser estuary 15 mi n w of Bremen pop 114 070 shipbuilding
B 300 maps G 88 E 424
- Bremerton** Wash city on Puget Sound 15 mi w of Seattle pop 5000 15 mi w of Puget Sound Navy Yard (established 1891 build and repairs all classes of naval vessels) dairy products fruit lumber maps U 252 1967 W 44
- Brennan College** at Gainesville Ga for women opened 1878 liberal arts
- Brendan Saint** (484-577) Irish abbot called the Voyager patron of sailors supposed to have discovered a beautiful land by sailing west festival May 16
- Brenner Pass** lowest pass over Alps (summit 4511 ft.) railway opened 1867 A 180 T 232b maps D 18 E 423
- Brent** strategic value T 185
- Brennus** (*brénus*) chief of Gauls led sack of Rome in 390 B C
- Brent Charles Henry** (1862-1929) American Episcopal clergyman, born New ss le Ontario Canada bishop of Ehipp Islands 1901-18 bishop of New York 1918-26 active in campaign against opium author of religious books
- Brent Margaret** (1800-1870 or 1871) pioneer in women's rights movement came from England to Maryland 1819 W 184
- Brent of Bin Bin** pen name of anonymous 19th century Australian novelist known for books about Australian squatters Miles Franklin credited by some with the share in authorship of The Country Back to Bo Boole See also in I dr Franklin Miles
- Brentwood Pa borough** 5 mi se of Pittsburgh residential suburb pop 13 635 map street P 132
- Breza Palace** Milan Ita y M 247
- Breza** (*bréza*) Fox play of Joel Chandler Harris's Uncle Remus stories pict w F 200
- Breer Rabbit** hero of Joel Chandler Harris's Uncle Remus stories out vlt Brer F x H 271 272 pictures L 214 F 200 H 272
- Brescia** (*brésha*) Italy ancient city at foot of Alps 50 mi e of Milan pop 141 633 Roman ruins fine arms textiles paper ways I 262 E 428
- Bresinsky** (*bréskínskí*) Catharine (1844-1934) Russian social worker called Grandmother of the Revolution on aristocratic parentage exiled to Siberia upon so to Bolsheviks in later years conducted schools of Hidden Springs of Russia Revolution
- Breslau** (*bréslau*) Pn sh Wrocław (wrocław) Poland former capital of Prussian Sasia on Oder River included in Poland since 194 pop 341 410 university textiles machinery trade in grain live stock metals coal timber maps E 416 F 344
- Brest Peace** of (1742) closed first Slesian War Austria forced to grant Slesia to Frederick the Great of Prussia
- Brest France** seaport of Brittany pop 62 707 B 300 maps F 259 D 425
- Brest-Litovsk Bridge** See in Index
Brest-Litovsk
- Brest Litovsk** (*bréslitovsk*) also Brest Russia fortified town for merly Polish on Bug River 120 mi e of Warsaw pop 60 000 railroad and manufacturing center taken by Germans after long resistance in 1918 by Russia 1939 and again by Germans June 1941 included in Russia since 1945 W 223 maps E 417 F 344 P 267
- Brest Litovsk Peace** of (1918) treaty between Germany and Russia W 226 R 289
- Brestagne France** See in Index
Britany
- Brest German Baptist** See in Index
Dunkers
- Brethren** Plymouth See in Index
Plymouth Brethren
- Bretigny** (*brétní*) Treaty of (1360) in Hundred Years' War H 416
- Bretherton** (*bréttón*) André (born 1896) French poet novelist and critic born Titchbray France supported Dadaism founder of surrealism movement (Vladia auto biographical novel)
- Breton Jules** (1837-1908) French painter best known for gracious and skillful portrayal of French peasant life (Song of the Lark Return of the Gleaners) also wrote poetry and prose
- Breton** (*brétn*) Nicholas (1543-

- 1626), English writer; stepson of George Gascoigne (pastoral poems: 'The Passionate Shepherd'; prose idyl on angling; 'Wits Trenchmour').
- Breton Club**, origin of Jacobins J-290
- Brettonne**, Restif de la. *See* in *Index* Restif de la Bretonne
- Bretons**, people of Brittany B-327
- language C-163**
- Brett, George H(oward)** (born 1886), U. S. Army officer, born Cleveland, Ohio; pioneer in military aviation; in service in s.w. Pacific 1942; commanding general Caribbean defense Nov. 1942-Sept. 1946; retired from active duty 1946.
- Bretton Woods conference** I-197, W-297, M-338
- Breuer (broi'ér)**, Josef (1842-1925), physician of Vienna from whose early experiments grew the methods of psychoanalysis; collaborated later with Sigmund Freud.
- Breuer, Marcel Lojos** (born 1902), Hungarian modernist architect and furniture designer, born Pécs, Hungary; research professor at Harvard University after 1937
- modern house interior, picture A-400/**
- Breughel**, family of painters *See* in *Index* Brueghel
- Brevet**, a military commission giving an officer temporary higher rank but not higher pay than his permanent rank; former title in the U. S. Army.
- Brevet medal**, U.S., a decoration of honor D-38
- Breviary (bré'ti-är-i)**, book used in Roman Catholic church containing daily service for the canonical hours; usually divided into four volumes, one for each season of the year; includes psalms, lessons, antiphons; reading required of priests and all members of religious orders.
- Brevier (bré-vér)**, type T-228
- Brevitype**, a machine for writing shorthand S-167
- Brewer, David Josiah** (1837-1910), American jurist, born Smyrna, Asia Minor; influenced public opinion and development of law in U. S.; justice Supreme Court of Kansas, Supreme Court of U. S.; member Venezuelan Boundary Commission.
- Brewer's blackbird** B-203
- Brewster, Sir David** (1781-1868), Scottish scientist, discoverer of the laws of polarization of light kaleidoscope invented by K-1
- Brewster, William** (1567-1644), Pilgrim leader and one of founders of Plymouth B-300-1
- Brezina (bzhé-zé-nä)**, Otokar, pen name of Václav Jekavy (ná'bá-vé') (1865-1929), Czech poet; wrote symbolic and mystical verse ('The Music of the Springs'; 'Daybreak').
- Brian Bora (brén bô-rô)**, or Brian of the Tribute (926-1014), "high king" of Ireland 1002-14, slain after victory over Danes at Clontarf; figures in legend and history.
- Briand (bré-än')**, Aristide (1862-1932), French statesman B-301, picture B-301
- Briar Cliff College**, at Sioux City, Iowa; Roman Catholic; for women; opened 1930 as junior college; senior college 1937; arts and sciences, commerce, home economics.
- Briard (bré-ärd')**, dog, table D-118a
- Briareus (brí-ä-ré-üs)**, in Greek mythology, giant son of Uranus U-405
- Briar stitch**, or featherstitch, in sewing S-112, diagram S-111
- Briarwood**, root of heather H-320
- Brices Cross Roads**, national battlefield site in Mississippi; established 1929; Civil War battle; here Gen. Nathan B. Forrest led Confederate cavalry with skill in battle, June 10, 1864.
- Brick B-302-5, pictures B-302-4**
- adobe B-302; houses S-144c, pictures A-301, N-168**
- ancient use B-302, A-305, S-144-144a, pictures A-301, 306, B-302; Great Wall of China C-277, picture C-282**
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- modern use B-304-5, pictures B-345, 346**
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- straw, why used B-302, C-340**
- sun-baked brick B-302, A-299, pictures A-301, B-302**
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- terra cotta B-344, pictures B-345, 346a**
- Brick cheese C-207**
- Bricks without straw B-302, C-340**
- Brick tea T-32**
- Bridalveil Fall**, in Yosemite National Park, California Y-341a
- Bridal wreath (spirea) S-352**
- Bride, Saint. See in Index Bridget**
- 'Bride of Lammermoor, The'**, novel by Sir Walter Scott, published 1819; heroine is Lucy Ashton who loves the master of Ravenswood but is compelled to marry the laird of Bucklaw; becomes insane, stabs her husband on wedding night, and dies 'Lucia di Lammermoor' O-391
- Bride of the Adriatic (Venice, Italy).**
- Bride's Well**, originally royal palace in London, named from St. Bride's Well in vicinity; given to city of London as reformatory by Edward VI in 1553; in use for 300 years. Name now used for any house of correction for minor offenders.
- Bridge. See in Index** Nautical terms, table
- Bridge B-305-11, pictures B-305-11. See also in Index** names of various bridges, and table of famous bridges on following pages
- arched B-306, pictures I-229, I-267; camel-back, China, picture C-281; principle A-297, pictures B-311, M-159**
- bascule B-306, pictures B-309, 311**
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- cantilever B-306, 308, pictures B-307, 309, 311**
- concrete construction: prestressed, picture C-431; reinforced B-306, picture B-311**
- covered bridge, picture B-305**
- drawbridge**
- bascule B-306, pictures B-309, 311**
- lift bridge, picture B-307**
- medieval castle, picture C-133**
- pivot, picture N-115**
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- jackknife B-306, picture B-311**
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- Nihon-bashi, Tokyo T-145**
- noted bridges of world B-308**
- pontoon bridge. See in Index** Pontoon bridge
- strain of heat, wind, traffic B-306**
- suspension. See in Index** Suspension bridge
- trestle bridge B-306, 308, pictures B-306, U-419**
- wire cables W-163, picture W-162**
- Bridgeman, William Clive**, Viscount (1864-1935), British first lord of the Admiralty; active in parliamentary affairs since 1889; secretary of mines; home secretary; created viscount 1929.
- Bridge of Sighs**, covered bridge in Venice, Italy; so called because condemned prisoners formerly passed over it from the judgment hall to place of execution: V-444, picture V-447
- Bridge of Ten Thousand Ages, China F-209**
- Bridgeport, Conn.**, 3d city of state, on Long Island Sound; pop. 154,709; B-312, maps C-444, U-253
- Bridgeport, University of**, at Bridgeport, Conn.; founded 1927; arts and sciences, business administration, dental hygiene, education, engineering, nursing, Arnold College of Health and Physical Education; graduate school in education.
- Bridger, James** (1804-81), fur trader and scout, famed for daring and for knowledge of Northwest; born Richmond, Va., later moved to St. Louis; in 1822 joined Ashley's expedition and continued in fur trade for 20 years; discovered Great Salt Lake 1824; built way station, Fort Bridger, in s.w. Wyoming 1843; guide for Stansbury exploration 1849. *See also in Index* Stansbury, Howard
- Bridges, Robert** (1844-1930), English poet, poet laureate (1913-30); at 38 abandoned medicine for literature; verse scholarly and of high quality with beauty and a serene joy in life the chief themes: 'The Testament of Beauty', his last work, published on 85th birthday, is a philosophical poem in 4 books ('Achilles in Scyros', 'The Christian Canticle', poetic dramas: 'Milton's Prosody', criticism): E-382a
- Bridges Creek, Va.**, early ancestral home of Washington W-17
- Bridget, Brigit, Brigid, or Bride, Saint** (452?-523?), one of the chief saints of Ireland; founded church and monastery of Kildare; festival February 1.
- Bridget of Sweden, Birgitta, or Brigitta, Saint** (1303?-73), founder of Brigittines, order of nuns, born near Uppsala, Sweden, of family famed for piety and wealth; patroness of Sweden; festival, October 8.
- Bridgeton, N. J.**, port and manufacturing city on Cohanese River near Delaware Bay; pop. 18,378; glass, canning factories; important settlement in colonial days; map N-165
- Bridgetown, capital of Barbados, West Indies**; pop. 13,340; map W-96a
- street vendors, picture W-95**
- Bridgewater Canal**, England C-108a
- Bridgewater College**, at Bridgewater, Va.; owned by Church of the Brethren; founded 1880; arts and sciences.
- Bridging. See in Index** Architecture, table of terms
- Bridgman, Laura Dewey** (1829-89), American blind deaf-mute B-206
- Bridgman, Percy Williams** (born 1882), physicist, born Cambridge, Mass.; taught at Harvard University 1910-54; received 1946 Nobel prize in physics for discoveries in the field of high-pressure physics.
- Brie (bré)**, district of France between Seine and Marne rivers
- cheese C-207**
- Brief, in debating D-27**
- Brief, in law. See in Index** Law, table of legal terms
- Brienne-le-Château (bré-én' lü shä-**

Key: cape, át, fär, fäst, what, fall; mé, yét, fém, thére; ice, bit; rōw, wōn, fōr, nōt, dō; cāre, būt, rŭde, fŭll, būrn; out;

WORLD'S MOST NOTABLE BRIDGES—Concluded

| NAME | LOCATION | MAIN SPAN LENGTH (FEET) | TOTAL LENGTH (FEET) | HEIGHT ABOVE WATER (FEET) | TRAFFIC | YEAR OPENED | COST |
|---------------------------------|--|-------------------------|---------------------|---------------------------|---------|-------------|-------------|
| Swing Span Bridges | | | | | | | |
| Fort Madison (Santa Fe) | Mississippi River, Fort Madison, Iowa | 531 | 3,330 | 7 | R-H | 1927 | \$5,500,000 |
| Willamette River | Portland, Ore. | 521 | ... | 144 | R-H-T | 1908 | |
| East Omaha | Missouri River, Omaha, Neb.—Council Bluffs, Iowa | 520 | 1,608 | 12 | R | 1903 | |
| Bascule Bridges | | | | | | | |
| Sault Ste. Marie | Sault Sainte Marie Canals, Sault Ste. Marie, Mich. | 336 | 3,607 | 13 | R | 1941 | |
| Erie Avenue | Black River, Lorain, Ohio | 333 | 1,430 | 33 | H | 1910 | 1,500,000 |
| Chattanooga (Chief John Ross) | Tennessee River, Chattanooga, Tenn. | 310 | 2,300 | 14 | H | 1917 | 1,050,000 |
| Pontoon Bridges | | | | | | | |
| Lake Washington Floating Bridge | Lake Washington, Seattle—Mercer Island, Wash. | 202 | 8,583½ | ... | H | 1910 | 8,854,000 |
| Hobart | Derwent River, Hobart, Tasmania, Australia | 180 | 3,165 | ... | H | 1944 | 1,100,000 |

*Suspension-cantilever bridge. †Other concrete arch bridges in the world have longer main spans, but this is the longest concrete arch span in the United States. ‡Other plate girder bridges in the world have longer main spans than the last two bridges, but they are the longest plate girder spans in the United States. §Includes 6561-foot floating section and approaches. Entire bridge project with a tunnel and roads is 6½ miles. H—Highway. UC—Under construction. RT—Rapid transit. ER—Electric railway. T—Trolley. R—Railroad.

tô'), France, small town 23 mi. n.e. of Troyes on Aube River; indecisive battle between Blücher and Napoleon (1814); Napoleon studied at military school (suppressed 1790) Napoleon at N-6, picture N-7
 Brienz (bré'nts), Lake, in Switzerland, in canton of Bern; expansion of Aare River; about 9 mi. long and 1½ mi. wide; map S-475
 Brier, or briar, any thorny plant of the genus *Rubus* or any wild-growing rose
 Briellies-sur-Meuse (bré-ül' sür-mûz), French village on Meuse River, 15 mi. n. of Verdun.
 Brieux (bré-ü'), Eugène (1858–1932), French dramatist; stressed social subjects; a reformer rather than a literary artist ('The Red Robe'; 'Damaged Goods'; 'L'Enfant').
 Brig, ship S-151
 Nancy W-143
 Briga (bré'gak) River, in s. Germany; with Brege River forms source of Danube River.
 Brigade, in U. S. Army, formerly unit of 3400 to 6900 men; in infantry, cavalry, field and coast artillery; not used in triangular division.
 Brigadier general
 U. S. Air Force, table A-384; insignia, picture U-238
 U. S. Army, table A-384; insignia, picture U-238
 U. S. Marine Corps, table A-384
 Brigantine, ship S-151
 Briggs, Clare (1875–1930), cartoonist, born Reedsburg, Wis.; among his best-known series were 'Skin-nay', 'The Days of Real Sport', 'When a Feller Needs a Friend', 'Ain't It a Grand and Glorious Feeling', and 'Mr. and Mrs.'
 Briggs, Henry (1561–1630), English mathematician, born Warley Wood; proposed decimal logarithmic system in use today (Briggsian, or common, logarithms); calculated logarithmic tables ('Arithmetica Logarithmica'; 'Trigonometria Britannica').
 Briggs, Lyman James (born 1874), physicist, born Assyria, Mich.; with U. S. Dept. of Agriculture 1896–1920; National Bureau of Standards from 1920; on National Research

Council since 1945; known for research on soil moisture and analysis and aerodynamics
 Brigham City, also Brigham, Utah, city 20 mi. n. of Ogden; pop. 6790; settled as Box Elder 1851, renamed 1856 to honor Brigham Young; peaches, beet sugar, canned goods, woollens; maps U-416, U-252
 Brigham Young University, at Provo, Utah; founded and endowed, 1875, by Brigham Young; under control of the Latter-day Saints (Mormons); high school and college of arts and sciences, applied science, commerce, education, fine arts; graduate school.
 Bright, Sir Charles Tilston (1832–88), English engineer; helped lay first transatlantic cable; C-7-8
 Bright, John (1811–89), English liberal statesman and brilliant orator, born Lancashire; a Quaker; lifelong friend and co-worker of Cobden; began a long parliamentary career as chief orator for the Free Trade movement; greatest speech was in opposition to the Crimean War; reached height of his popularity as champion of Parliamentary Reform Bill of 1867; E-369c
 Bright-line spectrum S-331, 332, diagram S-332
 Brighton (brí'ton), England, popular seaside resort 50 mi. s. of London; pop. 156,440; map B-325, picture E-349
 Brighton Beach, New York City C-432
 Bright's disease K-39
 Brigit, Saint. See in Index Bridget, Saint
 Brigitta, Saint. See in Index Bridget of Sweden, Saint
 Brilliant, or rhinestone, a colorless imitation stone J-350
 Brilliant cut, in diamond cutting D-78, picture J-350
 Brilliant type T-228
 Brimstone, old name for sulfur S-447
 Brindisi (brén'dé-zé), Italy, ancient Brundisium, chief Roman seaport on Adriatic; now commercial town of 35,984; Roman ruins; center of airlines connecting with the East; maps I-262, E-425

Brine, salt solution S-29
 freezing, use in F-284
 Brink, Carol Ryrie (born 1895), author of children's books, born Moscow, Idaho; Newbery medal (1936) for 'Caddie Woodlawn', the story of her grandmother on the Wisconsin frontier in 1864 ('Anything Can Happen on the River'; 'Baby Island'; 'Magical Melons').
 Brisbane, Arthur (1864–1936), newspaper editor, born Buffalo, N. Y.; editor *New York World*, *New York Evening Journal*, *Washington Times*; noted for direct, forceful, popular style of editorials, appearing chiefly in papers owned by William Randolph Hearst.
 Brisbane, Australia, capital of Queensland, on Brisbane River 25 mi. above mouth; pop. 402,172; exports wool, hides, gold; Q-12, map A-489
 Briseis (brí-sé'is), maid loved by Achilles A-8-9
 Bristlecone fir, rare evergreen tree (*Abies tenuis*) of pine family, native to Santa Lucia Mountains, Monterey County, Calif. Grows 30 ft. to 100 ft. high; spirallike. Leaves stiff, pointed, to 2½ in. long, dark green with 2 white bands on underside. Cones to 4 in. long, bristly appearing because of thin spines that extend beyond edges of the bracts (leaflike parts of the cone).
 Bristles H-242
 use in brushes B-330
 Bristol, Conn., city 15 mi. s.w. of Hartford; pop. 35,961; clocks and watches, automobile bearings, scissors; famous in 15th century for wooden clocks; map C-444
 Bristol, England, city 8 mi. from Bristol Channel, pop. 442,281; B-312, map B-325
 Bristol, Pa., borough on Delaware River 20 mi. n. of Philadelphia in rich farming region; pop. 12,710; manufactures textiles, airplanes, carpets, leather, chemicals; map P-133
 Burlington Bridge. See in Index Bridge, table
 Bristol, R. I., in Bristol County, on Narragansett Bay, 13 mi. s.e. of Providence; pop. of township, 12,320; partly destroyed during Revolutionary War; site was once

Key: cape, át, fár, fást, what, fall; mé, yét, fèrn, thére; ice, bit; rów, won, fór, nót, dq; cáre, bítt, rýde, fýll, bárn; out;

THE BRITISH COMMONWEALTH AND EMPIRE

| | | |
|---|----------------------------------|---|
| Europe: | | |
| United Kingdom of Great Britain and Northern Ireland (with Channel Islands and Isle of Man) | | |
| Ossetia | colony | |
| Malta | self governing colony | |
| Americas: | | |
| Bermuda (islands) | colony | |
| British Guiana | colony | |
| British Honduras | colony | |
| Canada | sovereign state | |
| Falkland Islands | colony | |
| West Indies | | |
| Bahamas | colony | |
| Barbados | colony | |
| Jamaica (with Cayman Islands and Turks and Caicos Islands) | colony | |
| Leeward Islands | colony | |
| Trinidad (with Tobago) | colony | |
| Windward Islands | colony | |
| Africa: | | |
| Anglo-Egyptian Sudan | condominium (with Egypt) | |
| Basutoland | colony | |
| Bechuanaland Protectorate | protect rate | |
| Cameroon (British sphere) | trustee h p | |
| Gambia | colony and protectorate | |
| Gold Coast | colony and protectorate | |
| Kenya | colony and protectorate | |
| Mauritius (island) | colony | |
| Nyasaland | colony and protectorate | |
| Rhodesia Northern | protectorate | |
| Rhodesia Southern | protectorate | |
| St. Helena (with Ascension Island and Tristan da Cunha) | colony | |
| Bechuanaland (British sphere) | colony | |
| Seychelles (islands) | colony | |
| Serra Leone | colony and protectorate | |
| Somaland (British sphere) | protectorate | |
| Swaziland | protectorate | |
| Tanganyika Territory | trusteeship | |
| Togoland (British sphere) | trusteeship | |
| Uganda Protectorate | protectorate | |
| Asia (cont.): | | |
| Union of South Africa | | sovereign state |
| South West Africa | | mandate under the Union of South Africa |
| Zanzibar (with Pemba) | | protectorate |
| Asia: | | |
| Aden | | colony and protectorate |
| Borneo | | |
| North Borneo (w. Labuan) | colony | |
| Brunei | protectorate | |
| Malaya | colony | |
| Ceylon | sovereign state | |
| Cyprus | colony | |
| Hong Kong | colony | |
| India | sovereign state | |
| Federal of Malaya | protectorate | |
| Maldives Islands | protectorate | |
| Pakistan | sovereign state | |
| Singapore | colony | |
| Australasia and Antarctica: | | |
| Antarctica | | sovereign state |
| Antarctic | | |
| Territory | (uninhabited) | |
| No folk land | colony | |
| Papua (to partly British New Guinea) | colony | |
| Queensland | trusteeship under Australia | |
| Western Territory of | trusteeship under Australia | |
| East and West Islands | condominium (with United States) | |
| Fiji Islands | colony | |
| Libert and Elice Islands | colony | |
| New Hebrides | condominium (with France) | |
| New Zealand | sovereign state | |
| Angland Cook and Tokelau and Herdman Islands and Ross Dependency | dependence on New Zealand | |
| Western Samoa | trusteeship under New Zealand | |
| Pitcairn Island | colony | |
| Solomon Islands | protectorate | |
| Tonga | protected state | |

home of Indian chief King Philip
man R 141
Mount Hope Bay Bridge See in
Index Br digo table
Bristol Tenn and Va two contiguous
cities near the corner of Tennessee
pop (Tenn) 167-1 (Va) 1694
King College (Tenn) Sul
f as College and Virginia Internorm
College (Va) combined products
textiles electronic equipment
calculating machines chemicals food
processing maps T 87 L 233 inset
V 486
Bristol Bay Inlet of Bering Sea n of
Alaska Benaula maps A 135
N 250
Bristol Channel arm of Atlantic be
tween s Wales and s w England
maps B 321 326
Britain (Latin name Britannia) Eng
lish form of ancient name of E
land Scotland and Wales now
sometimes applied to all of British
Isles For geography and later
history see in Index Great Britain
Arthurian legends A 393-4 W 3
Britons F 557-8 C 183 baskets
B 73 See also in Index Celts
history D 357-8 Christianity in
introduced E 359 C 113
London early history L 298
Britain battle of (1940) W 251-2 277
Britannia Latin name of Britain
C 173
Britannia the Pride of the Ocean
British patriotic song V 40
Britannic metal alloy of tin and
copper and sometimes zinc
proportions vary according to in
tended use first made in Sheffield

England in 1770 largely sup
planted pewter
Britain (A.D. 437-55) son of
Emperor Claudius poisoned by
stepbrother Nero
British America phrase usually ap
plied to Canada but more broadly
to all British territory in the Ameri
cas—Canada Bermuda British
West Indies British Honduras Brit
ish Guiana and Falkland Islands
British Broadcasting Corporation R 49
British Central Africa See in Index
Rhodesia and Nyasaland Federa
tion of
British Columbia westernmost prov
ince of Canada 366 255 sq mi
pop. 116,000 cap. Victoria
B 319-17 C 76 maps C 68 63 pic
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Preservational Park N 39/ Yoho
National Scenic and Recreational
Park N 39/
Peace River F 102-3

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Vancouver Is and V 437
British Columbia University of at
Vancouver British Columbia Can
ada opened 1915 provincial con
trol arts commerce applied sci
ence during agriculture
British Commonwealth and Empire
B 317 20 map B 318 See also in
Index England history of Great
Britain also table on this page
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changing status E 371 272 B 319-
20
colonies and other dependencies
B 319 20 C 390 map B 318 See
also table on this page
Commonwealth members B 319-20
map B 318 See also table on this
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decorations of honor D 39-40
dominions B 319 20 C 380
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foundations laid B 317
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British Commonwealth of Nations
B 319 C 192 See also in Index
Little Commonwealth and Em
pire also table on this page
British East Africa. See in Index East
Africa British
British East India Company A 190
C 487 E 365 539
American Colonies I 122

6=French n German d gem so thin then n=French nasal (Jean), th=French f (f in azure) x=German guttural ch

- India I-68; Clive C-351-2; Hastings H-280; Calcutta C-21
- British Empire, Order of, established 1917 to reward war service; conferred upon women as well as upon men.
- British Guiana, a crown colony on n.e. coast of South America: 90,000 sq. mi.; pop. 375,701. cap. Georgetown: G-222d-3, maps G-223, S-252
- Kaieteur Falls, picture S-277
- relationships in continent, maps S-252-3, 255-7, pictograph S-246
- Venezuela boundary dispute V-442, 444
- British gum (dextrin) D-77
- British Honduras, a British colony in Central America, 5,908 sq. mi., pop. 59,220; cap. Belize mahogany and logwood, chicle bananas, citrus fruits, cacao, founding of colony credited to British buccanniers early in 17th century; Great Britain's rights clearly recognized (1798) after revolt of Central America from Spanish rule C-177, Y-344, maps C-172, Y-345, N-251. See also in Index Central America
- relationships in continent, maps N-245-6, 248, 250-1, 255
- sponge fisheries S-354
- British India, that part of India which was directly subject to British law I-68-68a, map I-68a. See also in Index India
- British Isles, name popularly applied to Great Britain Channel Islands, Ireland Isle of Man and numerous surrounding islands: area 120,860 sq. mi.; pop. 53,330,184. B-320-7, maps B-324-5, 321, E-416, pictures B-320, 322
- Channel Islands C-185, picture C-185
- climate B-320
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- Great Britain G-173-8, pictures G-173-4, Reference-Outline G-174-7; England E-346-56, maps B-321, 324-5, E-347, pictures L-346, 348-56; Scotland S-62-5, pictures S-62, 63a-5; Wales W-3-4, picture W-3
- Hebrides H-327
- Ireland: Northern Ireland I-230b-2, pictures I-231-2; Republic of Ireland I-226-30b, maps I-226, 227, pictures I-226, 228-30a
- Man, Isle of M-71
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- people: racial classification, chart R-22
- relationships to continent, maps E-416-17, 419-20, 429, 429d
- Shetland Islands S-148
- tea consumption T-28, 32
- Wight, Isle of W-133-4
- British Malaya, British possessions in Malay Peninsula and nearby islands, including Singapore and the Federation of Malaya: 31,163 sq. mi.; pop. 5,558,163; maps I-123, A-407. See also in Index Malay Peninsula; Malaya, Federation of; Singapore
- British Museum, London, England L-305, E-441, map L-301, picture E-446. See also in Index Museums, table
- Assyrian dictionary, picture L-181
- Bible manuscripts B-137, picture B-134
- Boticelli's 'Abundance' D-140a, picture D-140a
- collections, pictures E-446
- Curtin's painting of a coffeehouse, picture E-369
- Elgin Marbles A-12
- figures from the Parthenon, picture G-200
- medieval medallion, picture J-346
- royal library L-183, B-246
- British New Guinea, former name of Papua N-143
- British North America Act C-91, 99
- British North Borneo. See in Index North Borneo
- British oak O-319-20
- British Somaliland, or Somaliland Protectorate, protectorate in n.e. Africa bordering Gulf of Aden; 68,000 sq. mi.; pop. 700,000; chief town Berbera: maps A-46, E-402
- relationships in continent, maps A-46-7, 41-2, 39, 51
- British South Africa Company B-144
- British thermal unit (B.T.U.) H-319, table E-344c
- British Union, flag of the United Kingdom of Great Britain and Northern Ireland F-138c, color picture F-133
- British West Indies, those islands of West Indies belonging to Great Britain; include Bahamas, Barbados, Jamaica, Leeward Islands, Windward Islands and Trinidad and Tobago. See also in Index West Indies, also names of islands and groups
- Britomart, maiden representing chastity, in Edmund Spenser's 'Faerie Queene' (from Britomartus, a nymph of Crete, made goddess by Artemis)
- Britons E-357-8, C-163. See also in Index Celts
- Brittany, French Bretagne (br̄-tan'-yē) historic province of n.w. France B-327, maps F-270, E-424, pictures B-327, F-260
- Brest B-300
- Carnac picture F-271
- Celtic culture C-163
- doll, color picture D-122c
- Nantes N-4
- people F-259, B-327
- surface F-261
- Brittany spaniel, dog D-110a, table D-118
- Britten, (Edward) Benjamin (born 1913), English composer, born Lowestoft; in U.S. 1939-42; has written music for motion pictures ('Love from a Stranger') and plays (by Auden and Isherwood); also operas ('Gloriana', for coronation of Queen Elizabeth II, and 'Peter Grimes') and chamber operas ('Rape of Lucretia', 'Albert Herring').
- Brittle stars, a type of starfish S-363
- Brno (br̄-nō), formerly Brünn, (brūn), Czechoslovakia, city in Moravia, 70 mi. n. of Vienna: pop. 258,333; woolen manufactures; university; history dates back to 9th century: maps C-535, G-88, E-425
- Broach to. See in Index Nautical terms, table
- Broadax, a tool, picture P-263
- Broad bean V-466, B-84
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- television T-50-5, pictures T-50-54d
- vocational opportunities R-44
- Broadcloth, a fine, lustrous woolen fabric; also fine, closely woven cotton or silk fabric with mercerized surface.
- Broadhorn, a flatboat, picture P-265
- Broad irrigation S-110
- Broad-leaved trees, one of the two great tree divisions T-178, 184, 185
- Broad razor (*Tagelus californianus*), clam shell, color picture S-139b
- Broad River, a stream rising in the Blue Ridge Mountains of North Carolina and flowing s.e. through South Carolina, joining with Saluda to form the Congaree; about 250 mi. long and navigable for small boats about 141 mi. above Columbia, S. C.: maps X-268, S-290
- Broadsword, a single-edged, broad-bladed sword used for cutting rather than thrusting; the claymore, a two-edged broadsword, formerly the national weapon of the Scottish Highlanders.
- Broadtail, silken wavy fur of newborn or prematurely born lambs, especially the Karakul and other broad-tail breeds.
- Broadway, street in New York City N-218-19, picture N-220
- number of electric signs E-314
- Broddingnag (brōd'-ding-nāj), in 'Gulliver's Travels' G-229, S-470
- Broca (brō'-kā'), Paul (1824-80), French surgeon and anthropologist; founded Anthropological Society of Paris, 1859; localized seat of articulate speech in brain.
- Brocade, originally a heavy silk with a raised design in silver and gold threads, name now applied to any fabric with a raised design or a design which appears to be raised Italian Renaissance, picture T-105
- Brocatel, or brocatelle (brōk-a-tel'), a rich, heavy fabric of Jacquard weave used for draperies and upholstery; has a raised design; often made of silk and linen; also a kind of variegated marble.
- Broccoli (brōk'-lī, Italian brōk'-kō-lē), a vegetable of the mustard family (*Brassica oleracea italica*); said to have been brought to Italy from Cyprus: C-1
- Broché (brō'-shā'), fabric woven with a raised design, as a brocade.
- Brock, Emma Lillian (born 1856), illu-trator and author of children's books, born Fort Shaw, Mont.; animals chief characters of picture books ('Runaway Sardine', 'Drusilla', 'Three Ring Circus') S-416
- Brock, Henry Matthew (born 1875), English illustrator and water-color artist, born Cambridge; illustrations for works of Thackeray, Leigh Hunt, and Holmes; drawings for *Punch* and other magazines illustration, picture D-380a
- Brock, Sir Isaac (1769-1812), British general, 'hero of Upper Canada'; aided by Tecumseh, captured Detroit in the War of 1812; killed during American attack on Queenston Heights: picture C-97
- Brock, Sir Thomas (1847-1922), English sculptor; distinguished for power and skill in portraiture; work includes bust of Longfellow in Westminster Abbey, London, and portraits of Queen Victoria and Thomas Gainsborough.
- Brocken, highest peak in Harz Mountains (3747 ft.) H-250
- Brock-et, a South American deer D-44
- Brockton, Mass., city 18 mi. s. of Boston, one of most important centers in world for manufacture of men's shoes: pop. 62,860; map M-153
- Brockville, Ontario, Canada, port, railroad, and manufacturing city on St. Lawrence River 60 mi. s. of Ottawa; pop. 12,301; dairy and lumber products, hardware, copper wire, cables, hats: map C-72
- Brockway, Howard (1870-1951), composer, born Brooklyn, N. Y.; orchestral works ('Sylvan Suite'); compiled folk songs of Kentucky mountains.
- Brod (brōt'), Max (born 1824), German writer of novels, short stories,

Key: cape, at, far, fast, what, full; mē, yēt, fērn, thēre; ice, bit; rōw, won, fōr, nōt, dō; cire, bāt, ryde, full, bŭrn; out;

and dramas born in Prague of Jewish parents (Redemption of Tycha Strafe Reuben)

Brodie Steve American adventurer who is believed to have jumped from Brooklyn Bridge into East River in 1846 went over Niagara Falls in rubber suit in 1849 gave name to expression do a brodie to jump or take a chance

Bröggerite (*brö gër it*) a radioactive mineral M 265

Broglie (*brö bî*) Louis Victor prince de (born 1823) French scientist born Dieppe brother of Maurice due de Broglie noted for work on méchanîc of wave lengths electricity optics X rays won Nobel prize in physics 1929 for his discovery of wave character of electrons author of Matter and Light and The Revolution in Physics L 344d P 238

Broglie Maurice due de (born 1875) French physicist born Paris brother of Louis Victor prince de Broglie known for researches in X rays and nuclear physics member of French Academy

Broiling in cookery C 463

Broken Hill Austral a mining town in w of New South Wales pop 27 059 map A 489 mine A 484

Brooker B 213 S 388b

Brooker or "nature companion" Australian crane C 807

Bromberg Poland See in Index Bydgoszcz

Brome grass a genus (*Brom* a) of annual and perennial grasses native to temperate regions of the world Smooth brome (*B. inermis*) used as hay and pasture grass Some species are pests and dangerous to livestock when the long clusters of barbed fruits mature

Brome lily a small genus of perennial plants of tropical America of the pineapple family has dense clusters of reddish flowers succeeded by plum-shaped fruit spiny leaves used for hedges in the tropics fruit juice used for a beverage also called pinguin and wild pine

Bromelia a family pineapple family or Bromeliaceae (*brö mé li* a c) a family of plants or shrubs native chiefly to warm regions including the bromelia pinguin pineapples and Spanish moss

Bromfield Louis (born 1896) novelist born Mansfield Ohio (The Green Bay Tree Posses on the Early Autumn Pulitzer prize 1927 The Strange Case of Mrs Ann Spragg The Farm The Raina Came Mrs Parkington Wild Country)

Bromide a compound of bromine with a metal or a radical cadmium, in photography C 13 silver in photography P 221 pictures P 214 218

Bromine a chemical element tables P 151 C 214

Dead sea product P 47

Photographic use P 221 picture P 214

poisonous properties P 341

Bronchi (*brö ki*) (singular bronchus) the two main branches of the windpipe or trachea L 351 color pict re P 243

Bronchitis L 351 diagram L 351

Broncho a so bronzo a small horse of western North America H 428d picture A 62

bronco busting C 153

Brou or bean See in Index Jumping bean

Brounhart (*brön hür*) Adolphe Theodore (1803-78) French botanist pioneer in plant physiology

authority on classification of fossil plants

Brown Wilfred Swaneourt (born 1894) art author and illustrator of children's books born Morgan Park Chicago studied at Chicago Art Institute member of tropical expeditions on which he collected material for his first two cities (Fingerlings and Paddewines) later books on nature study (Coyotes Starlings Turtles Cats)

Brownstein Leon real name of Leon Trotsky T 192

Bronz (*brön id*) Anne (1870-49) pseudonym Acton Bel Eng ch author B 328 D 380b

Bronz Charlotte (1816-45) pseudonym m Currier Bell English no el at B 328 E 380b 1 picture B 328 Jane Eyre pict re D 380b

Bronze Emily (1818-48) pseudonym F a Bell English author or B 328 E 380b-1 pict re B 328

Bronz taurus prehistoric reptile B 113 pict re B 114 116 P 245 skeleton found in Utah N 33

Brown Borough part of New York City pop 1 451 277 N 223 276 maps N 222 inset N 204 picture U 328

Brown Park Y Y zoo Z 350 354-5 357 N 223 pictures Z 354 355

Bronx Whitestone Bridge New York City See in Index Bronx table

Bronze alloy of copper and tin B 328-9 A 173 picture B 328 casting art developed in China S 83 methods of S 75 Gh bert's doors G 107 I 270 S 78a picture R 163

Indian sculpture picture I 96

Japanese work J 314 picture J 317 lamps Cre h and P m n L 28 1 tres G 201 L 89 prehistoric C 82 meta working M 177 178-9 Chinese C 277 S 83 Greek work p tres M 177 Japanese pictures M 179 J 314

pa m 179

Patina S 75

weights primitive color picture G 72

Bronze Age prehistoric period B 378 Britain L 357

Chinese ritual vessels C 277-8

Iron Age follows I 246

Bronzed grackle L 203

Bronze Star Medal a decoration of honor D 39 pict re D 39

Bronze Turkey T 221

Bronzino M (of Bronzino) (real name Agnolo also Angiolo or Agnolo di Cosimo Allori) (1503? 72) Italian artist of late Florentine school born Montelena Florence Italy a mannerist with elegant parlor style (Christ in Limbo Martyrdom of St Lawrence) painting of Cosimo de Medici picture M 183

Brown Alexander (born 1898) painter born Brooklyn N Y figure landscape genre painter decorated with modernists (George a Jungle My Son Sandy Katharine Hepburn)

Brown a small stream C 185

Brooke Alan Francis first Viscount Alsebrook of Brokeborough (born 1884) British army officer expert in technical warfare and army mechanization directed retreat from Dunkirk 1940 chief of the British Imperial General Staff 1941-48 made field marshal 1944

Brooke Dorothea heroine of George Eliot's Middlemarch

Brooke Folke Grenville first Baron (1854 1928) English statesman and poet born Warwickshire England four times member of Parlia-

ment 1892-1900 a favorite at court of Queen Elizabeth I friend and biographer of Sir Philip Sidney

Brooke Henry (1703-83) Irish author of children's books L 271

Brooke Leonard Leslie (1862-1940) English artist born Birkenhead illustrated Nursery Rhyme Book by Andrew Lang his picture books for children built chiefly on nursery rhymes and class as well known in America for his Johnny Crow books Ring o Roses picture L 210

Brooke Rupert (1837-1916) English poet of great promise died of blood poisoning in World War I wrote exultantly sensitively and vividly of life love beauty and warfare (Collected Poems) Lithuania a Drama in One Act)

Brooke Stoford Augustus (1830-1916) English de gyan writer critical and investigative studies of Tennyson Browning History of Early English Literature

Brooke family family of English rajahs of Sarawak Borneo Sir James (1803-68) first white rajah ruled 1841-68 suppressed piracy and head hunting and introduced civilization Sir Charles Johnson (1829-1911) nephew of Sir James ruled 1888-1911 Sir Charles Lyner (born 1874) son of Sir Charles rajah 1917-48 B 215

Brook Farm communist experiment 1841-47 at West Roxbury Mass by Transcendentalists George Ripley leader Hawthorne Margaret Fuller Channing Emerson Thoreau members or sympathizers inspired Hawthorne's Blithedale Romance C 215 See also in Index Fountain

Brookfield Ill suburb of Chicago pop 12 472 map inset I 36 zoo Z 380 g ant panda Z 359

Brookgreen Gardens in South Carolina

Paul Manship a Diana picture S 81

Brookhart Smith W (1809-1944) U S senator from Iowa born Missouri schoolteacher lawyer U S senator 1892-20 1923-23 Progressive Republican interested in farmer special adviser to Agricultural Adjustment Administration 1933-35

Brookhaven National Laboratory in Lpton N Y table A 470

Brookings S D city 52 mi n of Sioux Falls pop 1774 trade center for farming region South Dakota State College of Agriculture and Mechanic Arts map S 505

Brookings Institution Washington D C an amalgamation of the Institute of Economics Institute for Government Research and the Robert Brookings Graduate School of Economics and Government for research and research training in social sciences formed 1977

Brookline Mass resident suburb of Boston first settled in 1634 pop of township 67 582 B 360 P 65a map inset M 142

Brooklyn Polytechnic Institute of at Brooklyn N Y for men founded 1853 aeronautical chemical civil electrical and mechanical engineering educational in graduate division

Brooklyn Battery Tunnel New York City N 224 T 200 map B 329 picture 142a T 209-10

Brooklyn Borough (Kings) part of New York City on Long Island pop 2 438 175 B 329 N 216 maps N 222 B 329 inset N 204 pictures B 329 U 289

Brooklyn Botanic Garden B 262 button industry B 372 plants pictures H 264 U 284

Brooklyn Botanic Garden, in Brooklyn, N.Y.; established 1910; directed by a private corporation on land and in buildings owned by New York City; 50 acres; B-262

Brooklyn Bridge, over East River, N.Y. B-306, pictures N-221, A-390. See also in *Index Bridge*, table

Brooklyn College, at Brooklyn, New York City; part of the College of the City of New York; established 1930 by combining Brooklyn branches of City College and Hunter College; municipal control; arts and sciences, education; graduate school.

Brooklyn Navy Yard, in elbow of East River; purchased by U. S. 1801; repairs, builds vessels, conducts naval research; B-329, maps N-222, B-329

Brook minnow D-1

Brooks, Charles Stephen (1878-1954), author, born Cleveland, Ohio; retired from printing business 1915 to write; organized Little Theater in Cleveland; writings whimsical, witty ('Journeys to Bagdad'; 'Frightful Plays'; 'Luca Sarto')

Brooks, Gwendolyn (Mrs Henry Blakely) (born 1917), writer, born Topeka, Kan.; first Negro to receive Pulitzer prize (1950 for 'Annie Allen', poems); also wrote 'A Street in Bronzeville', poems, and 'Maud Martha', a novel.

Brooks, Joseph (1821-77), Arkansas political leader known for governorship conflict with Baxter A-371

Brooks, Phillips (1835-93), preacher, born Boston, Mass.; internationally famous orator, Episcopalian bishop of Massachusetts; wrote hymn 'O Little Town of Bethlehem' Hall of Fame, table H-249

Brooks, Preston Smith (1819-57), U.S. congressman from South Carolina (1852-56) assaults Charles Sumner S-450

Brooks, Van Wyck (born 1886), literary critic, born Plainfield, N.J.; literary editor, *The Freeman*, 1920-24; shows keen understanding in analyzing and interpreting recent tendencies in literature ('Letters and Leadership'; 'The Ordeal of Mark Twain'; 'Emerson and Others'; 'Flowering of New England', awarded Pulitzer prize 1937; 'New England: Indian Summer'; 'The World of Washington Irving'; 'The Times of Melville and Whitman'; 'Confident Years'; 'The Writer in America'; 'Scenes and Portraits', autobiography) Longfellow characterized by L-310

Brooks, Walter Rollin (born 1886), writer, born Rome, N.Y.; highly diverting nonsense stories for children ('Freddie the Detective'; 'Clockwork Twin'; 'Freddie the Cowboy')

Brooks, William Keith (1848-1908), zoologist, born Cleveland, Ohio; with Johns Hopkins University 1876-1908; teacher of many embryologists ('The Foundations of Zoology')

Brooks Range, Alaska, mountains across n. Alaska A-132, maps A-135, N-250

Brooks's, club in London, founded 1764 as Almack's Club; Sir Joshua Reynolds, Sheridan, Burke, C. J. Fox, Horace Walpole noted guests.

Brook trout T-193, color picture F-117

Broom, Jacob (1752-1810), public official, born Wilmington, Del.; signed United States Constitution.

Broom, Jacob (1808-64), statesman, born Baltimore, Md.; member House of Representatives from Pennsylvania; nominated by Native Amer-

ican party 1852 for president of U. S.

Broom, Robert (1866-1951), paleontologist, born Paisley, Scotland; author of books on comparative anatomy, vertebrate paleontology prehistoric man M-70

Broom B-330

Broom, shrub of the pea family emblem of the Plantagenets H-335

Broomcorn, any of certain varieties of *Andropogon sorghum*; head of the plant composed of bristly seed-bearing branches; when dried these make the "straws" of common brooms; first grown in America by Benjamin Franklin; now grown commercially in Illinois, Kansas, Colorado, New Mexico, Oklahoma, and Texas brooms B-330

Broomroot, a Mexican grass F-62, table F-63

Broomtail, a horse H-428d

Brotherhood of St. Andrew, an organization of men and boys in the Episcopal church, the object of which is "to aid in the extension of Christ's kingdom"; senior and junior departments, founded 1883 in Chicago, now international

Brother Jonathan, nickname for U. S. N-235

Brothers Karamazov (*kä-rä-mä-z'öf*), The, a novel (1880) by Dostoyevsky; tells tragedy of three brothers in provincial Russian town.

Brothers of the Christian Schools, an order of monks M-358

Brougham (*brō'am*), Henry, Baron (1778-1868), British lord chancellor and Liberal reforming statesman; made reputation as counsel for Queen Caroline in defense against divorce from George IV; his carriage forerunner of brougham.

Brown (*brōn*), Heywood (1888-1939), writer, born Brooklyn, N. Y.; educated at Harvard University; was successively newspaper reporter, sports writer, dramatic critic, literary editor, and columnist; identified with labor and social reform movements; wrote novels 'The Boy Grew Older', 'The Sun Field', and 'Gandle Follows His Nose'; breezy and outspoken humorist.

Brouwer, or Brauer (*brō'er*), Adrian (1606?-38), Flemish genre and landscape painter; peasants, tavern scenes favorite subjects; expert technician, colorist ('Sleeping Peasant'; 'Quarrelling Gamesters').

Brow. See in *Index Nautical terms*, table

Browallia (*brō-icäl'i-a*), annual plants of the nightshade family, native to South America. The small tubular flowers of blue, violet, or white grow in loose, elongated clusters; leaves smooth and oval.

Browder, Earl (born 1891), Communist party leader, born Wichita, Kan.; represented Red International of Labor Unions in China 1927-29; general secretary of Communist party in the U. S. 1930-41; convicted by New York Federal Court, 1940, of using false passport and sentenced to 4 years in prison, fined \$2,000; sentence commuted, May 1942; expelled from Communist party in U. S. 1945.

Browere, John Henri Isaac (1792-1834), sculptor, born New York City; known for life masks in plaster of famous Americans

Brown, Abbie Farwell (1875?-1927), writer, born Boston, Mass.; best known for imaginative children's stories ('In the Days of Giants';

'The Lonesomest Doll'; also wrote poems ('A Pocketful of Posies').

Brown, Alice (1857-1948), writer, born Hampton Falls, N. H.; analyzed New England characters ('Tiverton Tales', short stories; 'Children of Earth', drama).

Brown, Sir Arthur Whitten (1886-1948), English aviator; with Sir John Alcock made first nonstop transatlantic flight, table A-104

Brown, Charles Brockden (1771-1810), novelist, born Philadelphia, Pa.; first American professional man of letters ('Wieland' and other tales of terror); A-226a-b, picture N-310

Brown, Ford Madox (1821-93), English painter; realistic treatment of historical subjects painting by, picture C-201

Brown, George (1818-80), Canadian statesman, born in Scotland; one of earliest advocates of Confederation and one of first to foresee the development of Canadian Northwest; founded *Toronto Globe*; C-99

Brown, Henry Kirke (1814-86), American sculptor, noted for his statues of public men S-80

Brown, Jacob (1775-1828), U.S. Army officer, born Bucks County, Pa.; prominent in War of 1812; rose to rank of major general; distinguished himself at Fort Erie, Chippewa, and Lundy's Lane; became general in chief U. S. Army 1821.

Brown, John (Old Osawatimie Brown) (1800-1859), American abolitionist B-330-1, picture B-330

Harpers Ferry H-271, picture C-331 Kansas border warfare K-17, B-331 mural by Curry, picture B-330

Brown, John (1810-82), Scottish physician and author; 'Rab and His Friends' and 'Marjorie Fleming' extremely popular for their kindly, humorous characterization.

Brown, Marcia Joan, author-artist, born Rochester, N. Y.; her books for children are the result of experience as a storyteller in the New York Public Library ('Stone Soup', 'Dick Whittington and His Cat', 'Puss in Boots', 'The Steadfast Tin Soldier', and 'Cinderella', awarded Caldecott medal 1955).

Brown, Margaret Wise (1910-52), author and editor of children's books, born New York City; in 10 years she wrote and published more than 50 books under her own name and a pen name, Golden MacDonald, ('Goodnight Moon'; 'Golden Egg Book'; 'Red Light, Green Light'; 'Noon Balloon'; 'Where Have You Been'; 'The Little Island', awarded Caldecott medal in 1947 for his illustrations by Leonard Weisgard; 'Wheel on the Chimney').

Brown, Mather (1761-1831), portrait painter, born Boston, Mass.; descendant of Cotton Mather; lived in England after 1781

portrait of Jefferson, picture J-330

Brown, Paul (born 1893), artist and author of children's books; born Mapleton, Minn.; his specialty is drawings of horses in action expressed with humor ('Crazy Quilt'; 'War Paint'; 'Pony School').

Brown, Peter, carpenter on Mayflower; ancestor of John Brown, the abolitionist.

Brown, Prentiss Marsh (born 1889), public official, born St. Ignace, Mich.; U. S. congressman 1933-37, U.S. senator 1937-43; head of Office of Price Administration January to October 1943.

Brown, Robert (1773-1858), Scottish botanist, born Montrose, Scotland; naturalist 1801-5 in expedition

Key: cape, ät, fär, fäst, what fall; mä, yët, fërn, thére; ice, bit; rōw, wón, fōr, nót, dç; cûre, bût, rýde, full, búrn; out;

headed by Matthew Flinders for survey of Australian coasts discovered Brownian movement and also the distinction between gymnosperms and angiosperms

Brown Sidney George (1873-1945) English inventor born Chicago Ill. educated at University College London had nearly 1,600 patents invented the first relayed messages over long submarine cables the first practical loud-speaker for radio and a synchroscopic compass for ships and aircraft

Brown William Hill (1765-93) early American novelist poet and dramatist lived in Boston Mass. A 226a

Brown any of several colors consisting of strongly neutralized red or red yellows mixture of red and green pigment C 396-8

Brown ash See in Index Black ash
Brown bear B 86 89 pictures A 133 B 85

altitude range picture Z 362
Brown County Indiana I 71

state park picture I 83
Brown creeper, a bird color picture B 185

Brown Charles Farrar See in I & S Ward Artemus

Browne Lewis (1897-1949) writer born in England came to America in 1912 rabbi of Temple Israel Waterbury Conn. (1896-92) and of Free Synagogue Newark N J (1924-26) resigned to write illustrated some of his own work (Stranger than Fiction a history of the Jews 'This Believing World' an account of religions 'That Man in Me' All Things Are Possible)

Browne Maurice (1881-1955) English dramatist and play producer born in London England director Chicago Little Theatre produced Journeys End puppetry P 441

Browne Sir Samuel James (1824-1901) English army officer born India military service in India See also in Index Sam Browne Belt

Browne Sir Thomas (1805-82) English physician and author on rivalled master of stately rhythmic but artificial and Latinized prose (Religio Medici The Garden of Cyrus Urn Burial) E 377

Browne Thomas Alexander See in Index Boldwood Roll

Browne William (1591-1643) English pastoral poet born Devonshire (The Shepherd's Pipe)

Brownell Herbert J. (born 1904) lawyer and political leader born Pers. Neb. practiced law New York City 1927-32 served in New York State assembly 1933-37 campaign manager for Thomas E. Dewey 1942 (for governor of New York) 1944 and 1945 (for president of U.S.) chairman Republican National Committee 1944-46 became U.S. attorney general 1953 picture E 237

Brownell William Cray (1851-1928) literary critic born New York City (French Traits American Prose Masters Standards The Genius of Style)

Brown headed nothatch N 318
Brownian movement rapid haphazard movement of fine particles in solution visible in microscope caused by collision with molecules of solution discovered by Robert Brown in 1827

Brownie in Scottish folklore a good natured goblin F 11 & 413

Brownie Girl Scouts G 113-14

Browning Elizabeth Barrett (1806-61) English poet B 331 picture B 331

child labor attacked by C 249
Browning John W. (1855-1946) American inventor of firearms M 3

Browning Robert (1812-89) English poet B 331-3 E 320a picture B 331

quoted E 380a A 236a
Browning Automatic Rifle (BAR) F 56 54 F 76

Browning machine gun M 9 12 picture M 10 12

Brown Library Providence R I See in Index John Carter Brown L library

Brown pelican, a water bird P 114
state bird table B 158

Brown race See in Index Faces of mankind & M at races of mixed character etc

Brown rice F 76 picture R 76
Brown rice R 145

Brown white army nucleus of Nazi party in Germany H 385

Brownson Orestes Augustus (1803-78) writer born N. H. bridge 11

was a Unitarian Universalist in later life rate of socialistic theories

Unitarian organizer of a church of his own (1836 and 1840) (1844)

a convert to Roman Catholicism published Boston (Brown sons)

Quarterly Review
Brown Deep in Atlantic Ocean A 453

Brown sugar & 445
Brownsville Tex. city and port at mouth of Rio Grande pop. 26,066

important gateway for trade between Mexico and U.S. farming areas petroleum products T 80

map T 91 U 52 3
Brown Swiss dairy breed of cattle C 144 picture C 143b color picture M 350 table C 142

composition of milk table C 143
Brown tail moth, a white moth (Lithopha chrysorrhoea) with

larvae which are accident brown tipped

introduced into U.S. from Europe larvae cause great damage to shade trees in New England

control by parasites I 185
control damaged by E 335

Brown thrasher T 123-4
egg color pot re E 258a

state bird table B 193
Brown trout of Europe T 193

Brown University, at Providence R I for men co-ordinate college (Pembroke) for women founded

1764 present name 1904 in honor of Nicholas Brown a benefactor

arts science engineering education graduate school P 423 See also in Index Pembroke College

Brownwood Tex. city 120 mi. S.W. of Fort Worth pop. 20,181 flour cut

and cottonseed oil petroleum town and gasoline brick and tile cloth

and Daniel Baker and Howard Payne colleges map T 80

Bror or Brozovich Joseph See in Index Tito

Brace Sir David (1855-1931) British army physician and bacteriologist

born Melbourne Australia made lieutenant colonel 1900 did research in Malta fever and African

sleeping sickness
Brace Henry Addington (born 1874) American contributor to

Toronto Canada magazines and lecturer on psychology and sociology

tutor on psychology and sociology has done much to popularize psychology and psychological research

(The Riddle of Personality Psychology and Parenthood) See in Index Control and How to Gain It

Brace James (1735-94) Scottish explorer rediscoverer of source of

Blue Nile and first white man to find it from its source

union with White Nile A 49
Brace Robert (1274-1329) king of Scotland victor at Bannockburn

D 333 B 65
Brace Abbeville picture M 354

Bruce Stanley M. (1809-1871) Viscount Bruce of Melbourne (born 1803) Australian statesman (born

Melbourne) practiced law in London treasurer of Commonwealth

1921-23 prime minister 1973-29 Australian high commissioner in London 1940-45 chairman of

World Food Council 1947-51
Bruce William (1867-1921)

Scottish explorer of Arctic and Antarctic led Scott's National Antarctic expedition 1902-04 discovered

icebergs of Antarctica C 147
See also in Index Lindalland fever

Bruch (bruh) Max (1838-1920) German pianist and composer

(operas Lorelei and Hermione for violin and cello) and four

concertos cantatas probably his greatest works F. 1910 Salamis

Odyssey A 453
Bruce (bruh) Max (1838-1920) A 432

Bruckner Anton (1824-1896) Austrian organist composer

practically self-taught used principles of Wagner's dramatic opera in writing symphonies

Bruckner Edoard (1867-1927) Australian geographer and geologist

advanced climate cycle and theory in 1890 and collab. rated with All right Penck on The Alps During the Ice

Age C 35
Brueghel or Breughel (bruh) Jan

(1568-1625) Flemish artist son of Pieter Brueghel called 'the

elder' because of smooth technique painted flowers and landscapes for canvases of Rubens who

in turn painted figures in Brueghel's landscapes (The Garden of Eden)

Brueghel or Breughel Pieter the Elder (1564-1625) Flemish painter of

peasant life two sons Pieter the Younger (1564-1637) and Jan

Younger (1564-1637) and Jan Younger were also celebrated painters

See also in Index Brueghel Jan

The Harvesters by Pieter the Elder P 27d color picture P 28

Bruening (bruh) Heinrich (born 1885) German statesman and

financial expert army officer in World War I entered Reichstag

as member of that group becoming leader of that group

chancellor 1930-32 with practically dictatorial powers put through

dictatorial program which saved Germany from economic crisis in

1931 opposed Hitler for president voluntary exile from Germany

lecturer and professor of government at Harvard University 1937-51 professor of history University

of Cologne Germany after 1951
Bruce (bruh) (Flemish) George

German (Brugge) Belgium old Flemish town 55 mi. N.W. of Brussels pop. 52,748 B 332-4 maps

B 111 E 424 pictures B 116 B 333
book trade medieval B 233

Brain the character in beast epic of Bernard the Fox P 254

Bruce (bruh) (Flemish) Etienne (1502-1632) Canadian explorer born

Champigny France in 1604 emigrated to Canada and became an

Indian interpreter 1615 accompanied Champlain to the Huron country explored through Pennsylvania to Chesapeake Bay the

- first white man to reach Lake Superior (1622); murdered by Hurons.
- Brulé**, a tribe of the Teton Sioux Indians living chiefly in North Dakota.
- Bru'ndi**, Constantino (1805-80), American painter, born Rome, Italy; moved to U.S. 1852; became citizen; famous for frescoes in Capitol, Washington, D.C.
- Bru'mell**, George Bryan (1778-1840), "Beau Brummell," English dandy, dictator of fashion, early friend of Prince of Wales (King George IV).
- Brundisium**, Italy. See in *Index* Brundisi
- Bruneau** (brü-nö'), Alfred (1857-1934), French composer, influenced by his friend Zola, introduced into theater lyrics of realistic nature, some of his librettos based on Zola's novels ('L'Attaque du moulin').
- Brunei** (brü-né'), chief town of Brunei, Borneo; built on piles over Brunei River; pop 10,619. maps A-107, E-202
- Brunei**, protectorate in British Borneo; 2500 sq. mi.; pop. 40,657 B-255, map E-202
- Brunei**, Sir Marc Isambard (1769-1849), British inventor and engineer, born in France, perfected many inventions, including block pulleys for rigging of ships, wood-working machinery, machine for making seamless shoes, etc., but most famous for invention of a shield system of boring (after watching a shipworm at work), which he used in constructing Thames tunnel T-210
- Brunelleschi** (brü-né-lé-ski') Filippo (1377-1446), Italian architect, born Florence, called founder of Renaissance architecture, created theory of linear perspective, dome of Florence cathedral, picture F-147
- Ghiberti** and G-107
- Brunetiere** (brün-té-ri'), Ferdinand (1819-1906), French critic, editor of the *Revue des Deux Mondes* ('Histoire de la littérature française classique') quoted F-286
- Brunhild** (brün'hilt') (German Brünhilde), heroine in 'Song of the Nibelungs' N-232
- opera O-393, M-464
- Brunhilde**, also Brunnhilde, Queen (died 613), wife of Siegfert I. of Eastern Frankland and daughter of Athanagild, king of Visigoths; accomplished, beautiful, and an able ruler. When her sister Galwintha, wife of Chilperic, king of West Frankland, was murdered, Brunhilde waged war against Chilperic's kingdom. She was finally captured, tortured, and dragged to death by wild horses.
- Brunhoff**, Jean de (1899-1937), French artist; author and illustrator of children's books ('The Story of Babar')
- Brünn**, Czechoslovakia. See in *Index* Brno
- Brunne**, Robert of. See in *Index* Mannyns, Robert of Brunne
- Brunner**, Arnold William (1857-1925), architect, born New York City; designed many public structures, including Capitol Park State Office Buildings, Harrisburg, Pa.; widely influential in U.S. as city planner.
- Bruno** (brü-nö'), Saint (1580-1600), German monk; festival Oct. 6; founded Carthusian Order in 1684.
- Brano**, Giordano (1548?-1600), Italian Renaissance philosopher; began career as Dominican friar, but was expelled for heresy; his views brought him into conflict also with Calvinists and Lutherans; expanded teaching of Copernicus into a form of pantheism; attacked Christian doctrine of immortality; burned at stake in Rome Feb. 17, 1600.
- Brunswick**, Ga., seaport and popular resort in s.e. on St. Simons Sound, 4 mi. from Atlantic; pop. 17,954; fishing and canning interests; naval stores lumber; maps G-77, U-253
- Fort Frederica National Monument N-33, map N-18
- Brunswick**, German Braunschweig (brün'shvik), former state and duchy in w. Germany, area 1418 sq. mi. 1939 pop. 600,000, after World War II, incorporated into Lower Saxony (Niedersachsen)
- Brunswick**, Germany, city in Lower Saxony; pop. 223,760, map G-88
- Brunswick**, Me. town 25 mi. n.e. of Portland, pop. 7003; rayon, cotton goods, newsprint, paper boxes; Bowdoin College; map M-46
- Brunswick**, House of. See in *Index* Hanover House of
- Brusa**, Turkey. See in *Index* Bursa
- Brush**, Charles Francis (1842-1929), inventor, born Euclid, Ohio; pioneer investigator of electric lighting; invented a storage battery and many other devices; arc light developed by E-309
- Brush**, Christine Chaplin (1842-92), writer, born Bangor, Me. ('Colonel's Opera Cloak', story of Southern family in North, 'Inside Our Gate', story of own family)
- Brush**, George de Forest (1855-1941), painter, born Shelbyville, Tenn.; many "mother and child" groups, Indian subjects, portraits
- Brush**, of electric generator and motor E-290, picture E-291
- Brush drawing**, Chinese method of drawing with ink, the fluid strokes express the essence, rhythm, and vitality of the subject; C-277, D-139
- Wu Chen's 'Bamboo in the Wind' D-140d, picture D-140d
- Brushes** B-330
- paint P-42; artists' P-37c
- Brush turkey**, a bird of the group Megapodes, native to Australia and New Guinea; lives in brushwood egg hatching E-268
- Brushlov** (brü-scl'of), Alexei (1853-1926), Russian general; brilliant successes in Galicia 1914-15 and 1916; after revolution of 1917 was in supreme command; later accepted Bolshevik regime; W-226
- Brussels** (brüs'sel-), or Bruxelles (brü-sél'), capital of Belgium; pop. 154,838; B-334, maps B-111, E-416, 425, pictures B-114, 115
- Christmas celebration, picture C-294b
- Royal Museum of Fine Arts. See in *Index* Museums, table
- tapestry making T-13
- Brussels**, University of B-334
- Brussels carpet** R-252, picture R-248
- Brussels griffon**, toy dog, color picture D-116b, table D-119
- Brussels lace** L-78
- Brussels sprouts**, vegetable of cabbage type C-1, picture C-2
- when and how to plant, table G-19
- 'Brut'. See in *Index* Layamon
- Bruttium** (brüt'i-üm), ancient name of Calabria, Italy, map I-263
- Brutus**, Lucius Junius, legendary Roman patriot; one of first two consuls of the republic (509 B.C.); R-181-2
- Brutus**, Marcus Junius (85?-42 B.C.), Roman republican, one of Caesar's assassins although he had been aided by him; fled Rome and seized Macedonia; committed suicide when defeated at Philippi; cited in Shakespeare's 'Julius Caesar': C-14, 15, picture E-376b
- Brutus the Trojan**, mythical first king of Britain, grandson of Ascanius, the son of Aeneas.
- Bruxelles**, Belgium. See in *Index* Brussels
- Bruyère** (brü-yér'), Jean de la (1645-96), French essayist and wit; one of best writers of classical French ('Caractères', 'Mémoires').
- Bryan**, Charles Wayland (1867-1945), political leader, born Salem, Ill.; brother of William Jennings Bryan; Democratic candidate for vice-president of U.S. in 1924; governor of Nebraska 1922-23, 1921-35.
- Bryan**, John Neely, American pioneer, first white settler of Dallas, Tex. D-5, picture D-6
- restored cabin, picture D-5
- Bryan**, William Jennings (1860-1925), American political leader and editor B-334-5
- campaigns against McKinley M-18, 20
- home in Lincoln, Neb. L-251
- Statuary Hall. See in *Index* Statuary Hall (Nebraska), table
- Bryan**, Tex., residential city 85 mi. n.e. of Austin; pop. 15,162; fruit, livestock, and dairy market; maps T-90, U-253
- Bryant**, Sara Cone (born 1873), author born Melrose, Mass.; lecturer on storytelling ('Stories to Tell to Children', 'Gordon in the Great Woods', 'Story Reader').
- Bryant**, William Cullen (1794-1878), "father of American poets" B-335, A-225
- Hall of Fame, table H-249
- quoted A-226, d
- Bryce**, George (1844-1931), Canadian historian and Presbyterian clergyman; organizer of Manitoba College (1871); authority on Canadian Northwest ('Remarkable History of Hudson's Bay Company').
- Bryce**, James, Viscount (1832-1922), British statesman and historian, ambassador to U.S. ('The American Commonwealth', a classic; 'Modern Democracies', 'A Study of American History').
- Bryce Canyon National Park**, in Utah N-30, color picture N-25, maps N-18, C-414b
- Bryn Mawr** (brin mår) College, at Bryn Mawr, Pa.; for women; opened 1855 (founded 1890); arts and sciences; graduate school co-educational; picture C-384
- Bryology**, branch of botany dealing with mosses. See in *Index* Moss
- Bryophyta** (bryophytes), a phylum of the plant kingdom P-289, Reference-Outline B-264-5
- Bryozoa** (brü-ö-zö'a), or moss animals, Reference-Outline Z-364
- place in "family tree" of animal kingdom, picture A-251
- Brythonic languages**, a group comprising Welsh, Cornish, and Breton, belonging to Celtic branch of Indo-European family; so called from word "Brython," which means a Briton of southern stock
- Irish related to I-234
- B-scope**, type of radar R-27
- B.T.C.** See in *Index* British thermal unit
- Bubble gum** C-227
- Bubble-nest builders**, fish A-281
- Bubble nests**, of froghopper, picture N-59
- Bubble octant**. See in *Index* Octant
- Bubbles**, soap. See in *Index* Soap, sub-head bubbles
- Bubble sextant**. See in *Index* Sextant

Key: cape, dt, fär, fäst, what, fall; mé, yét, fern, there; ice, bit; rōw, wōn, tōr, nōt, dō; cāre, būt, rīde, full, būrn; out;

Bubble tower, for petroleum refining P 174 178 chart P 178-7
 Buhi group of Bantu speaking black tribes inhabiting island of Fernando Po w of Africa still in Stone Age at time of discovery

Bubonic plague epidemic disease R 203 See also in Index Black Death

carriers D 102 rat flea B 203 picture F 142

origin of German Passion Play O 323
 Bucaramanga (bg la-rá-mán gá) Colombia town in on Maricao River pop 73,000 coffee tobacco cotton gold silver maps C 337 B 252

Bucare a tree See in Index Erythrina

Bucaneros piratical adventurers (chiefly English and French) who in 17th century plundered Spaniards along coasts of West Indies and South America C 388 See also in Index Pirates and piracy

Bucephalus (bú-sé-fá-lus) favorite horse of Alexander the Great city of Bucephalus on Hydaspes (now Jhelum) River in India built by Alexander in his memory

Buchan (bú-dán) John first Baron Tweedmouth (1875-1940) British writer and statesman appointed governor general of Canada 1915 (novels Frester John The Thirty Nine Steps Greenmantle H at Ingstower The Three Hostages Mountain Meadow autobiography Pilgrims Way) E 36* quoted on Scott's Old Mortality* S 69

Buchanan (bú-dán) James (1791-1868) 15th president of the U S B 335-7 picture B 336 administration (1857-61) B 336-7 Brigham Young removed as governor of Utah U 410

Dred Scott decision D 141
 first Atlantic cable laid C 8
 Fort Sumter agreement F 242b his hostess in White House W 128 John Brown's raid B 331 Lincoln Douglas debates L-251-2 secession B 336

Ostend Manifesto C 332

Bucharest (bú-ká-rést) or Bucuresti (bg ká-rést) capital of Rumania 30 mi E of Danube River pop 1,041,807 B 337 maps B 23 E 417, pictures R 252 253

garlic vendor picture R 22

Bucharest Treaty of (1913) B 26 Rumania gains in territory F 254 Salonika given to Greece S 29

Bucharest University of state university of Rumania founded 1854 law medicine science philosophy theology mathematics

Buchanism an international movement for moral rearmament through God control started in 1921 by Frank N D Buchanan American Lutheran minister (born 1878) its members later first called Oxford Groups (M P A)

Re Armament Groups (M P A)

Buchner (bú-kner) Eduard (1850-1917) German chemist born Munich

chemist born Munich who claimed that alcoholic fermentation is caused by action of enzymes in yeast and not by yeast cells themselves won 1907 Nobel prize in chemistry

Buck Dudley (1839-1909) organist, composer and author born Hartford Conn. sacred songs anthems cantatas operas (Golden Legend)

Buck Frank (1884-1950) writer motion picture producer and collector of wild animals born Gainesville of Tex. began collecting jungle and

mal birds reptiles for U S zoos n 1911 expeditions to South America Malaya Ind a Borneo New Guinea

Africa motion pictures (also books written with E Anthony) Brang Em Back Alive Wild Cargo

Buck Pearl Sydneyaker (horn) writer born Haboro W Va spent childhood in China where her father and mother were missionaries in 1932 received Pulitzer prize for her novel The Good Earth received Nobel prize in literature 1938 (sons The Mother The Patriot Dragon seed The Village of Women The Child Who Never Grew) A 230f picture N 31

Buck boat S 183 picture S 182

Buck brigade in fire fight ng F 81 84 picture F 80

Buckeye B 337 picture E 337 See also in Index Horse chestnut growth of bud p tures N 48

Buckeye butterfly caterpillar and pupa color picture B 367

Buckeye state popular name for Ohio

Buckingham George Villiers first duke of (n Villiers ne) (1592-1628) British courtier union popular favor to of James I and Charles I (called Steele by James I) involved England in war with France assassinated by John Felton when he rejected Felton's appeal for captain's commission

"d duke of (Stafford Line) (1454-82) the chief though initially one of the chief supporters of Richard III in 1483 he led the revolt against him on behalf of the Earl of Richmond (Henry VII) R 151

Buckingham William Alfred (1804-75) governor of Connecticut C 451 75

Buckingham also Bucks or Bucking hamshire a midland county Eng land 143 sq mi pop 72,000 great dairying center map E 347

Buckingham Memorial Fountain Chl Buckingham III map C 231b picture H 457

Buckingham Palace London England L-304 map L 300

Changing of the Guard picture L 305

Buelle Henry Thomas (1821-6*) English historian (History of Civil action in England)

Buckley James Murray born Rahway minister and author born Rahway N J in Method st Episcopal N 13

1809-80 editor New York Christian Advocate 1890 1912 (Christians and the League)

Bucknell University at Lewisburg Pa Baptist chartered 1846 and sciences commerce and finance education engineering music graduate studies

Buckner Simon Bolivar (1823 1914) Confederate general and political leader father of Simon B Buckner governor of Kentucky 1887-91

surrenders to Grant G 162

Buckner Simon Bolivar Jr (1886-1945) U S Army officer born near Munfordville Ky son of Simon B

Buckner infantryman and special list in tanks Defense Force July 1940

Alaska Defense Force July 1940 commander 10th Army in Pacific theater 1944 killed by Japanese shell on Okinawa June 1945

Buckram a coarse highly sized cloth of linen or cotton one type used in various hats and garments for stiffening another widely used as book binding See in Index Buck

Bucks England

Buckingham leather L-150

Buckskin a leather L-150

Buckskin horse II 428a

Bucktail a fishing bait, list F 118g picture F 118d

Bucktails name given to members of Tammany Hall about 1817 26 from custom of members wearing a buck's tail in the r hats

Buckthorn or fraxinoid common name for trees or shrubs of genus Buxus of sapodilla family native to United States and tropics Borneo production B 255

Buckthorn family or Rhamnaceae (ram-nú-sé) a family of plants v nes shrubs and trees including the yulube buckthorn Japanese rais n tree coffee berry cascara and New Jersey tea

Buckwheel B 338

Buckwheel introduced into Europe C 532

Buckwheel family (Polygonaceae) large family of herbs includes buckwheel, rhubarb dock mountain sorrel and smartweed

Bucolies (bu-kú-les) (from Greek word for cowherd) pastoral poems of Greek and Roman poets part cularly Vergil

Bucovina or B kovina (bg kó-vú-ná) region in ne Rumania and w Ukraine former crownland of Austria Hungary 4031 sq mi chief city Chernovitz in Ukraine cattle raising and farming map A 407

Rumania acquires part R 254 R 231

Russia acquires part R 254 R 231

Bucovina Rumania See in Index

Bucharest

Bucyrus (bú-sú-ris) Ohio city on Sandusky River 63 mi se of Toledo pop 10,327 road construction machinery garden hose clay products railroad shops near numerous mineral springs map O 358

Bud undeveloped shoot forming stem flowers, or leaves N 48

adventitious E 227

leaf protection T 204 unfolding pictures N 48 H 354

Buda now part of Budapest, Hungary B 338

Budapest (bú-dá-pést or bú-dá-pésh) capital of Hungary pop 1,058,285 B 338 maps A 497 E 416-17 425 pictures H 449-50

Budida (bú-dá) originally Prince Siddhartha Gotama (said dā to go to me) (about 563-483 B C) Indian philosopher founder of Buddhism B 338-9 picture B 339

Benares home B 123

Do tree sacred to T 184 cutting from Ceylon in Ceylon C 180

scored mountain in Ceylon C 180

stories about S 408

Bodhiism an oriental religion B 339

Bodhiism B 361

ceremony burning joss sticks before Buddha picture C 274

Ceylon C 180 B 339

China C 274 influence on sculpture S 84

founder B 338 9 picture B 339

Hinduism and H 357

Japan J 299 518 shrine in home picture J 303 teachings repre sented by monkeys picture M 353

Kuan Yin goddess picture E 342

Lamaism in Mongolia M 344, in Tibet T 127-9

living Buddhas M 344

number of adherents B 339; India 1 55

Slam S 169 170

statues of Buddha Daibutsu J 514 picture J 317 Tibet, picture A 415

Buddhist architecture Angkor Vat I 125 pictures A 419

T 121

Cambodian royal grounds picture I 128

Japan J 314

Pagoda in Rangoon B 358 picture B 358

Temple of Boro Budur, Java J-328, picture J-326

Vat Arun, Bangkok, Siam, picture S-170

Budding, in bud grafting P-296, R-237
Budding, or gemmation, a mode of asexual reproduction in low forms of plants and animals in which an outgrowth on the parent results in the formation of a new individual: P-296

hydra H-456, picture A-250d

Jellyfish J-334, picture J-333

yeast Y-336

Buddleia, or **Buddleja** (*būd-lē'g*), a genus of shrubs and trees of the logania family; evergreen in tropics. Flower spikes of tubular lilac, white or yellow florets, leaves narrow; also called butterfly bush

Budejovice, Ceske, Czechoslovakia. See in *Index* Ceske Budejovice

Budenny (*bū'dēn-i*), Semion Mikhailovich (born 1883?), Russian general; cavalry leader in Bolshevik campaigns 1917-20, made 1st vice-commander of defense August 1940; commander in Ukraine July-Oct. 1941, trained reserves later

Budgell, *Eustace* (1686-1737), English writer; associated with Steele and Addison in writing for the *Tatler* and the *Spectator*

Budgerigar. See in *Index* Parakeet
Budget, a financial plan, term was originally applied to the black bag containing his statement of accounts carried by the British chancellor of the exchequer later to the contents of the bag, hence its present usage T-125, 126

budgetary control in industry I-141
household H-410, T-126; buying a home B-345; decorating a home I-185

reform in England L-286

Budget, Bureau of the, U S U-358

federal budget, chart T-24a

Budgie. See in *Index* Parakeet

Budweis, Czechoslovakia. See in *Index* Ceske Budejovice

Buell, Don Carlos (1818-98), soldier prominent in Civil War on Federal side; born near Marietta, Ohio; became major general of volunteers; after his Tennessee and Kentucky campaign he was replaced by Rosecrans (1862): C-336

Buenaventura (*bū-ā-nā-vēn-tō-rā*), Colombia, important Pacific port at mouth of Dagua River; pop. 23,000; coffee, hides, gold, platinum: C-388, maps C-387, S-552

Buena Vista (*bū'ng vīs'tā*, Spanish *bū-ā'nā vīs'tā*), battle of, in Mexican War M-186

Jefferson Davis and D-22

Buena Vista College, at Storm Lake, Iowa; Presbyterian; opened 1891; liberal arts.

Buenos Aires (*bū-ā'nīs ār'ēs*), Spanish *bū-ā'nīs ār'ās*), capital of Argentina, harbor on Río de la Plata, 165 mi. from sea; pop. 2,962,580: B-339-41, A-330, 334, 336, maps A-331, S-253, pictures B-340, A-334, 335

cities, world's largest. See in *Index* City, table

harbor, picture A-335

museum. See in *Index* Museums, table

Buff, Conrad (born 1886), American artist, born Switzerland; moved to California in 1905; well known for mural paintings and lithographs of the West; illustrator of children's books, chiefly those written by his wife, Mary Marsh Buff (born 1890), born Cincinnati, Ohio ('Dancing Cloud, the Navajo Boy'; 'Kobi, a Boy of Switzerland'; 'Dash and Dart'; 'Big Tree'; 'Peter's Pinto'; 'The Apple and the Arrow').

Buffalo, N. Y., at e. end of Lake Erie, 2d largest city of state; pop. 560,132: B-341-2, maps N-204, U-253, pictures H-264, N-213

Cleveland mayor C-344

museums B-342. See also in *Index* Museums, table

Buffalo B-341, picture B-341. See also in *Index* Bison

buffalo bird, or cattle heron B-341

Cape buffalo B-341

water buffalo, or carabao B-341,

P-197, pictures B-341, C-271,

P-196, E-273

Buffalo, American, or American Bison. See in *Index* Bison

Buffalo, University of, at Buffalo, N. Y.; founded 1846, arts and sciences, business administration, dentistry, division of general and technical studies education, engineering, law, medicine, pharmacy, social work, graduate school.

Buffalo Bayou, Texas H-434

Buffalo Bill (William Frederick Cody) (1846-1917), American frontiersman B-342, picture S-305

European tour B-277

marksmanship R-153a

Wild West show B-342, C-317, F-37

Buffalo Bill Dam, in Wyoming, on Shoshone River W-316, map W-322

Buffalo bird, or cattle heron B-341

Buffalo bug, or buffalo moth B-107

Buffalo bur, a low growing annual plant (*Solanum rostratum*) of nightshade family found in cent. North America Grows 1 ft to 2 ft. high; leaves and stems covered by white hairs; leaves lobed Flowers yellow 1 in. wide, 5 petals; fruit prickly. Sometimes called sandbur and bur grass.

Buffalo Dance, of Plains Indians, color picture I-97

Buffalo fish, name for several large fishes of sucker family (*Catostomidae*), found throughout Mississippi River valley; common, or big-mouthed buffalo (*Megastomatobius cyprinella*) and small-mouthed buffalo (*Ictiobus bubalus*) are important food fishes; resemble carp in habits.

Buffalo Gap, S. D. town in s.w. part of state, about 42 mi. s.w. of Rapid City; pop. 186: S-305, map S-302

Buffalo gnat, an insect closely related to the northern black fly; torments horses and cattle

eggs E-268

Buffalo moth, a beetle B-107

Buff-breasted sandpiper S-209

Buffer state, small independent state lying between two larger ones, thus either reducing the possibility of hostilities between them or bearing the brunt of their opposing armies.

Buffer systems, in chemistry C-219

Bufflehead, a diving duck (*Glauconetta albeola*)

nest D-158

Buffon (*bū-fōn'*), Georges Louis Leclerc, comte de (1707-88), French philosophic naturalist and writer ('Natural History') D-19, Z-361

Bug, an insect with sucking beak I-153. See also in *Index* Hemiptera; and names of individual bugs

aphids, or plant lice A-272-3, pictures A-272

assassin bug, color picture I-154b

bedbug, picture P-79, color picture I-154b

beetles not true "bugs" R-108

chinch C-287, pictures C-287

cicada C-306-7 pictures C-306

cochineal C-373

control S-356-7, G-17, C-287

lac insect L-82

leaf hopper, color picture I-154b

nymph stage I-156

scale insects S-53-4

scientific name I-160a

stinkbug, color picture I-154b

water bugs W-64-5, pictures W-64

Bug, a telegraph transmitter, picture T-37

Bugalev, Boris Nikolaevich. See in *Index* Byely, Andrey

"**Bug Bible**" B-137

Bugle, a wind instrument B-342,

H-427, picture M-471

Bug (*būf*) River, more than 450 mi. long, rises in w. Ukraine, Russia, flows n. along Russia-Poland boundary, then turns n.w. and w. into Poland to Vistula River: maps P-344, E-417, R-267

Bug River, or Southern Bug River, about 500 mi. long, in s.w. Ukraine, Russia; flows s.e. to estuary of Dnieper (Dnepr) River, at Black Sea: maps R-267, B-204

Bugs Bunny, cartoon character, picture M-426

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Heating and ventilating; Housing;

Shelter For list of terms commonly

used in building, see in *Index* Archi-

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elevators E-328-9, picture E-328

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fireproofing F-92, B-344, B-345-6:

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skyscrapers B-344

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materials, in building

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model housing projects, picture R-208

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tos A 401 diatomaceous earth
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stone S 38 slate S 194
stucco B 345
terra cotta B 344 pictures B 345
346a
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wire reinforcing W 163
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Buissan (bof soh) Ferdinand (1841-
1927) French statesman and edu-
cator member Chamber of Deput-
ties professor at Sorbonne win-
ner Nobel peace prize (1927)
Bultenzer (bottén shér) or Bokor
(bô jôr) city in Java pop 124
000 J 327
Bukhara (bô khar) or Bokhara
(bô khar) former em state and its
capital in Asiatic Russia n of Af-
ghanistan following Russian Revo-
lution Bukhara became a soviet
republic later divided between
Turkmen SSR and Uzbek SSR
city Bukhara (p p 60 000; now in
Uzbek SSR T 214 map A 406
rugs R 250
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jard
Bukovina, region in Rumania and
Ukraine See in Index Bucovina
Bulawayo (bô lû wô) +61 munic pality
in Southern Rhodesia South
Africa chief city of Natalaland
pop 80 188 Cecil Rhodes buried
nearby R 144b maps E 199 A 47
Bulla (buh-lâ) and pustulaka B 348
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sweet potato S 488
tulip T 203 4 picture T 203
vegetal reproduction B 348 pic-
ture P 297
Rabul or a Persan nightingale N 237
ecient *see* name N 237
Bulfinch Charles (1753-1844) archi-
tect born Boston Mass designed
Bear n Shil monument Boston and
built many public and private build-
ings in New England appointed
architect of Capitol at Washington
D C 1818 and designed west ap-
proaches and portico his sincere
simple style greatly influenced
American architecture
Old State House at Hartford Conn
C 443
Bulfinch Thomas (1796 1867) au-
thor born Newton Mass best
known for his *Age of Fable* still
published as *Bulfinch's Mythology*
other works *Age of Chivalry*
Legends of Charlemagne
Bulgakov (bô lû kôf) Michael
Atanasievich (1851 1940) Russian
novelist and playwright Days of
the Turbins portrays a White
Russian family Molire depicts a
playwright under censorship
Bulgaria (bô lû gâr) Nikolai Al-
eksandrovich (born 1905) Russian
government official mayor of Mos-
cow 1931-37 elected to Central
Committee of Communist party
1939 to Politburo 1946 promoted
to marshal 1947 minister of armed
forces 1946-49 A deputy premier
under Stalin a first deputy premier
and minister of war 1953-55 pre-
mier 1955 R 222a b picture
R 222a
Bulgaria (Bulgarian People's Re-
public) Balkan republic, 42 800
sq mi pop 7 000 000 cap Sofia
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tures B 349
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Bokor (bô kôr) (1789-1858) Cana-
dian soldier and governor of Assin-
iboia (1822) born Newfoundland
Bulhead of ships S 158 See also in
Index Nautical terms picture

Bull (bô l) Ephraim Wales (1806-95)
horticulturist born Boston
produced Concord grape C 155
Bull (bô l) Ole (1810-50) Norwegian
violinist and composer born Ber-
gen Norway composed fantasias
on national themes also concertos
Bull (bô l) constellation *See* in Index
Taurus
Bull in finance B 214 S 399
Bull male of domestic cattle and
many other animals especially e k,
moose elephant whale seal
preventing attack by picture S 12
Bull panel P 86
Bull Golden *See* in Index Golden
Bull
Bullard Robert Lee (1861-1947)
US Army officer born Youngsboro
Ala served in Spanish American
War in World War I commanded
1st Division and 3d Army Corps
also 2d Army A C F retired 1925
Bullbat or nighthawk N 238b picture
N 235b
Bullboat R 219
Bullhead D 110b color picture D 115
table D 119
bull mastiff table D 118a
French bulldog table D 119
Bull terrier D 143 pictures D 142 143
fire line bulldozer picture F 239
Bullen Frank Thomas (1857-1915)
English writer of sea stories (*The
Crucible of the Cachalot*)
Bullfinch F 15 B 258 258a pictures
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antimony used A 264
arsenic used A 389
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shrapnel A 398
stopping power A 236a picture
A 236
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Bulletproof vest A 377
Bullet tree *See* in Index Bulata
Bull fighting
in Portugal P 279
in Spain S 317 picture S 317
Manet's *The Dead Toreador* P 31b,
color picture P 31b
Bullfinch a sweet singing European
bird (*Pyrrhula pyrrhula*) of which
family named from its short,
rounded bill which suggests the
head of a bull male blue gray and
black above bright red beneath
can be taught to whistle tunes
Bullfinch F 301
classified B 162
Bullhead a catfish C 139
Bullion (bô l-yô) uncoined gold and
silver in bars or ingots M 292
Bullionist theory T 165
Bullion state popular name for Mis-
sour
Bullitt William Christian (born
1891) diplomat born Philadel-
phia Pa attaché to American Com-
mission 1919 Peace Conference
ambassador to Russia 1933-36 to
France 1936-41 special assistant
to secretary of navy 1943-4
Bull mastiff dog table D 118a
Bull Moose party *See* in Index Pro-
gressive party
Bullock William A (1813-67) inven-
tor born Greenville N Y P 41d
Bullock's oriole O 425 color picture
B 183
Bull Run battles of also called battles
of Manassas map C 335
first battle B 350 C 533-4
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Bull's-eye lamp picture L 94
Bull's-eye lantern L 94
Bull Shoals Dam in Arkansas on
White River *See* also in Index
Dams table
Bull snake S 208
ford S 207
Bull terrier D 110b color picture
D 111 table D 118b

Bull whackers, drivers of oxen teams in the early pioneer days, from bull-whack, a short-handled whip with a long lash.

Bülou (*bü'lo*), Bernhard, prince von (1849-1929), German statesman and diplomat, imperial chancellor (1900-1909); ambassador to Italy (1893-97), special ambassador (1914-15) in attempt to keep Italy in Triple Alliance, it was charged that his foreign policies helped to cause World War I.

Bülow, Friedrich Wilhelm, Baron (1755-1816), Prussian general, at battle of Leipzig 1813; overran Holland and Belgium; aided Wellington at Waterloo.

Bülow, Hans Guido von, Baron (1830-94), German pianist conductor, and profound student of music literature, toured in U.S.

Bulrush, any of several large rushlike or grasslike plants especially the genus *Scirpus* of the sedge family; name sometimes given also to the cattail; the bulrush of the Bible was a species of papyrus. S-96

Bulshain, also Traleika, or Denali, native names for Mt McKinley

Bulwer, Sir Henry. See in Index Dalling and Bulwer

Bulwer-Lytton. See in Index Lytton

Bumble, fat, self-important beadle who is a tyrant over workhouse inmates in Charles Dickens' 'Oliver Twist'.

Bumblebee, or humblebee B-93, 96, 99, W-52, color pictures W-51, B-97, I-154d, P-420b

pollinates red clover C-359

Bump'po, Natty, frontiersman in Cooper's 'Leatherstocking Tales'; nicknames include Deerslayer, Hawkeye, the Pathfinder, Leatherstocking. C-468

Buna (*bu'na*), New Guinea, village on n. coast of Papua; Japanese established bases here and at Gona (15 mi. n.w.) in July 1942; recaptured by Allies Dec 1942; map E-203

Buna rubbers R-245, 246

Bunchberry, or dwarf cornel, a red-berried herb (*Cornus canadensis*) of the dogwood family; flowers greenish-white to creamy, sometimes pink-tipped; color picture P-420a

Bunche (*bū'ch*), Ralph J. (born 1904), American Negro educator, and public official B-350-1, picture B-350

Buncombe, county in N. C.; pop. 124,403; word "bunk" originated in 1820 when Congressman Felix Walker made a lengthy speech on the Missouri Compromise, explaining that his district expected it, and he was "speaking for Buncombe"; map, inset N-274

Bund (*bünd*), in Oriental countries, quay or water's-edge promenade Shanghai, pictures H-265, S-133

Bund (*bünd*, German *bunt*), German-American, organization of German-Americans, formed in 1936 in U.S.; became dominated by Nazis; sought to foster anti-Semitism.

Bundesrat (*bū'ndes-rät*), the senate of the former German Empire, appointed by and representing the federated states; had administrative, judicial, legislative powers; sessions not public.

Bun foot, in furniture I-177

Bungalow, a one-story house; name and house originated in India.

Bunin (*bu'nin*), Ivan Alexeyevich (1870-1953), Russian novelist and poet; Nobel prize in literature 1933 ('The Gentleman from San Francisco'; 'The Well of Days'); R-295

Bunker. See in Index Nautical terms, table

Bunker Hill, battle of B-351-2, map B-351

flag F-130c, color picture F-128

Trumbull's painting P-31-31a, color picture P-30

Bunker Hill Day, June 17 F-57

Bunker Hill Monument, in Boston, Mass B-352, B-260, picture B-259

Bunner, H(enry) C(nyler) (1855-96), writer, born Oswego, N.Y.; short stories, novels, light verse; editor of *Puck* ('The Midge'; 'Zadoc Pine'; 'Short Sixes').

Bunsen (*bū'n'sen*, German *bun'zén*), Robert Wilhelm Eberhard (1811-99), German chemist B-352, picture B-352

burner B-352-3, picture B-353
gaseous action explained by G-106
spectroscopic studies S-331, B-352, P-231, picture A-428

Bunsen burner, a gas burner developed by Robert Bunsen B-352-3, picture B-353

Bunting, bird of finch family B-353

indigo B-353, picture F-68

lark bunting state bird, table B-158

snow B-353, picture B-177

Bunting, colored cotton cloth of plain weave similar to cheesecloth used for flags also a material of worsted yarn similar to nun's veiling but narrower and coarser.

Bun'yan, John (1628-88), English Puritan leader and author of 'Pilgrim's Progress' B-354-6, picture B-354

place in English literature E-377, N-311

Bunyan, or Bunyon, Paul, hero of lumber camp tales B-356, F-197, L-341, picture F-198

place in American folklore F-197

statue in Bemidji, Minn., picture M-290

versions of the legend S-418, 423

Buonarroti. See in Index Michelangelo

Booy (*bo'i* or *boi*), a navigation aid B-238, picture N-75. See also in Index Nautical terms, table

acetylene-lighted A-7

Buoyancy, ability to float; applied to supporting medium or the thing floated

Archimedes' principle A-303, L-262, diagram L-263, picture A-76

balloons B-28d-9, 30, A-453

liquids L-262

ships, diagram L-263

Buran (*bo-ran*'), a blizzard R-258, S-172, W-150

Burbage, or Burbadge (*bū'r'big*), James (died 1597), English actor, theater manager; one of owners of Blackfriars Theater; S-119, 120

Burbage, or Burbadge, Richard (1567?-1619), English actor of time of Shakespeare S-119

Burbank, Luther (1849-1926), American plant breeder B-356-7, picture B-356

berries R-76

birthday celebrated F-56

Burbank, Calif., city n.e. of Los Angeles; pop. 78,577; aircraft and aircraft components, motion pictures, pottery, pharmaceuticals; map, inset C-35

motion-picture studio, picture M-412

Burbot, fresh-water fish (*Lota maculosa*), also called ling or lawyer; only member of cod family found exclusively in fresh water.

Burchfield, Charles Ephraim (born 1893), artist, born Ashtabula Harbor, Ohio; realistic paintings of "the Americanscene"—streetscenes, freight cars, drab houses, fields—

also imaginative and mystical works
'November Evening' P-22, picture P-22

Bur clover C-360

Burdekin River, Queensland, Australia, rises on e. slope of Great Dividing Range and flows 350 mi. into Pacific in lat. 19° 45' S., map A-489

Burden, Henry (1791-1871), American inventor, born Scotland; patented first cultivator used in U. S.

Burden basket, used by American Indians, picture I-106a, 108c

Burden frame, used by American Indians, picture I-101

Burdett-Coutts (*bū'r-dēt' kōts*), Angela Georgina, Baroness (1814-1906), English philanthropist, greatest heiress of her time

Burdette (*bū'r-dēt'*), Robert Jones (1844-1914), humorist, minister, and writer, born Greensboro, Pa.

Burd'gala, ancient name of Bordeaux B-252

Burdock, a coarse biennial (*Arctium*) of the family *Compositae*, with large heart-shaped leaves and purple or pale violet flowers surrounded by stiff pointed bracts with hooked tips; color picture F-179

Bureau, in U. S. government. See in Index Census. Bureau of; Standards Bureau of etc

Bureaucracy (*bū-rū'krā-si*), a system of government the control of which is largely in the hands of officials organized into bureaus or departments. The power of such officials (bureaucrats) usually lies in the fact that they are empowered to interpret the laws and to issue regulations for law enforcement. The liberties of the citizens and the interests of the state as a whole tend to be ignored in favor of the policies and ambitions of the bureaucrats.

Burette (*bū-rēt'*), a chemical measuring tube.

Bureya (*bu-rā'yā*), river in s.e. Siberia, flowing into the Amur River above Khabarovsk; navigable for about 200 mi. above mouth.

Burgas (*boy'gās*), port of Bulgaria, on Black Sea; pop. 43,684; called *Pyrgos* in Middle Ages; flour and sugar mills; soap factories; maps B-23, B-204, E-417

Bur'genland, industrial district in Austria on w. border of Hungary; 1532 sq. mi.; fertile soil; awarded to Austria by Treaty of Trianon, 1920; steps to occupy region in 1921 resisted by Hungary; dispute ended in 1922 by giving Austria all but town of Sopron and its environs; Burgenland annexed by Germany 1938; returned to Austria 1945.

Bürgermeister. See in Index Burgomaster

Burgess (*bū'r'jēs*), (Frank) Gelett (1866-1951), author, illustrator, and humorist, born Boston, Mass. ('Goops and How to Be Them'; 'Are You a Bromide?'; 'Look Eleven Years Younger') quoted C-459

Burgess, John William (1844-1931), educator and writer, born Giles County, Tenn.; authority on political science, history, and constitutional law; professor at Columbia University 1876-1912.

Burgess, Thornton Waldo (born 1874), author, born Sandwich, Mass.; a boy spent great deal of time outdoors observing nature; well known for children's "bedtime stories" ('The Adventures of Reddy Fox', etc.); also wrote books on flowers, birds, animals.

- born Henderson, N. Y.; planned Chicago's World's Fair of 1893: C-232, C-323a
- Burnham, Sherburne Wesley** (1838-1921), astronomer, born Thetford, Vt.; professor of astronomy, University of Chicago; made important discoveries in double stars.
- Burning F-73-4.** See also in *Index* Combustion
- Burning bush.** See in *Index* Spindle tree
- Burning glass,** a convex lens L-168, picture L-165
- Burnley,** England city in Lancashire 22 mi. n. of Manchester, pop. 54,950, cotton and worsted weaving, iron manufactures: map B-325
- Burns, John** (1858-1943), first labor member English House of Commons 1892-1918; president local government board 1905-14 of board of trade 1911; opposed England's entrance into World War I and retired to private life
- Burns, Robert** (1759-96) Scotland's greatest poet B-361-2, E-379, picture B-362
- Burns, Tommy** (Noah Brussa) (1881-1953), Canadian boxer born Hanover Ontario heavy-weight champion B-271, table B-272
- Burns, William John** (1861-1932), detective born Baltimore, Md.; chief U. S. Secret Service 1921
- Burnside, Ambrose Everett** (1824-81), Union general in Civil War, born Liberty, Ind.; commanded McClellan's left wing at Antietam, succeeded McClellan in command of Army of Potomac Nov. 7 1862; removed after defeat at Fredericksburg, but served as subordinate until end of war; governor of Rhode Island 1866-69, U.S. senator 1875-81; gave name to a style of side whiskers F-283, C-335
- Burnt alum** A-181
- "Burnt starch"** (dextrin) D-77
- Bur oak, or mossy cup oak** O-319, 320, table W-186c
- Burpee, Lawrence Johnston** (1873-1916), Canadian historian and author; excellent on early Canadian explorers ('Search for the Western Sea'; 'Discovery of Canada'; 'Dictionary of Canadian History')
- Burr, Aaron** (1756-1836), 3d vice-president of the United States B-362-3
- conspiracy B-363, J-332c
- duel with Hamilton H-253, B-363
- election V-466b
- Burr, Theodosia** (1787-1813), daughter of Aaron Burr B-363
- Burr, of plants**
- chestnut: pictures C-226, 227
- Burrhel** (*bûr'el*), or blue sheep, a wild sheep S-136
- Burrinjeck Dam,** in Australia, on Murrumbidgee River. See also in *Index* Dam, table
- Burritt, Elihu** (1810-79), philanthropist and reformer, born New Britain, Conn.; being both linguist and blacksmith, earned title of "Learned Blacksmith"; organized, 1846, League of Universal Brotherhood for Abolition of War; attended various peace congresses ('Sparks from the Anvil'; 'Walks in the Black Country')
- Burro** (*bûr'ô*), a small donkey A-424. See also in *Index* Ass
- Burroughs, Bryson** (1869-1934), painter, born Hyde Park, Mass.; excelled at decorative landscape and fantastic interpretation of legends; curator of paintings, Metropolitan Museum of Art, New York City, after 1907.
- Burroughs, Edgar Rice** (1875-1950), writer of fanciful adventure stories, born Chicago, Ill. ('Tarzan of the Apes').
- Burroughs, John** (1837-1921), American naturalist and writer B-363, pictures B-363, R-225
- Burroughs, William Seward** (1857-98), inventor, born Rochester, N.Y. calculating machine C-18b
- Burroughs' Newsboys' Foundation,** Harry E., Boston, Mass.; established 1928 by Harry E. Burroughs, Russian-American lawyer and former newsboy, to raise the cultural level of the newsboy.
- Burrow**
- chipmunk C-287
- earthworm E-197, picture H-353
- gopher G-141
- mole M-332
- prairie dog P-406
- rabbit R-15, 16, picture R-18
- spider trap-door S-342, picture S-348
- toad picture H-353
- woodchuck, picture H-352
- Burrowing owl** O-431
- Bursa,** formerly *Brusa*, historic city of Turkey, 15 mi. s. of Sea of Marmara; pop. 100,007; hot sulfur and iron springs, silk and carpet manufactures: maps T-215, A-406
- Burslem** (*bûr'slem*) England famous pottery town in Staffordshire; birthplace of Josiah Wedgwood; in 1910 became part of Stoke-on-Trent: map B-325
- Burt, (Maxwell) Struthers** (1882-1954), novelist, born Baltimore, Md.; newspaper reporter and instructor in English at Princeton after 1908 lived chiefly on ranch in Wyoming; novels deal with contemporary life ('The Interpreter's House', 'The Delectable Mountains', 'Festival'). 'The Diary of a Dude Wrangler' is an account of his own ranch life. His wife, Katharine Neullin Burt (born 1882), is also a novelist.
- Burt, William Austin** (1792-1858), inventor and surveyor, born Peterborough, Mass.; self-educated inventor of "solar compass," surveyor's instrument still in use; government surveyor in Michigan and discoverer of iron ore in Marquette County; active in politics first typewriter patented T-231, picture T-231
- Burton, Harold Hitz** (born 1888), jurist born Jamaica Plain, Mass.; practiced law 1912-35; mayor, Cleveland, 1935-40; U.S. senator from Ohio 1941-45; named associate justice, U.S. Supreme Court, 1945.
- Burton, Sir Richard Francis** (1821-90), English explorer and writer; translator of 'Arabian Nights'; discovered Lake Tanganyika: A-292
- Burton, Robert** (1577-1640), English author; 'The Anatomy of Melancholy', curious, fantastic book, beloved by Lamb and Samuel Johnson: E-377
- Burton, Theodore Eliah** (1851-1929), legislator, born Jefferson, Ohio; served in both houses of Congress 30 years; important work in waterways development; president American Peace Society 1911-15 and 1925-29.
- Burton, Virginia Lee** (born 1909), artist, illustrator, and author of children's books, born Newton Center, Mass.; part of her childhood was spent in Carmel, Calif.; received Caldecott medal in 1943 for 'The Little House'; other titles: 'Katy and the Big Snow' and 'Mike Mulhigan and His Steam Shovel'; illustrated 'The Song of Robin Hood', edited by Anne Burnett Malcolmson.
- Burton, William Meriam** (1865-1954), chemist and business executive, born Cleveland, Ohio; president of Standard Oil Company of Indiana 1918-27
- oil cracking process P-177, table I-199
- Burton-on-Trent,** England, county borough in Staffordshire and Derbyshire; pop. 49,169; seat of brewing industry: map B-325
- Buru, island,** Indonesia. See in *Index* Boeroe
- Burunduk,** or Asiatic chipmunk, a ground squirrel living in forests of n. Asia as far as Ural Mts.; head and body 6 in. long, tail 4 in.; yellowish brown-gray, striped lengthwise with black; scientific name *Eutamias asiaticus*.
- Bury, John Bagnell** (1861-1927), Irish historian, regius professor of modern history in Cambridge University; edited Gibbon's 'Decline and Fall of the Roman Empire'; author of histories of Greece and Rome.
- Bury, England, town** in Lancashire 10 mi. n.w. of Manchester; pop. 58,829, cotton and woolen manufactures foundries: map B-325
- Buryat-Mongol Republic,** Russia. See in *Index* Buriat-Mongol Republic
- Bury St. Edmunds, or St. Edmundsbury,** England, town in W. Suffolk 60 mi. n.e. of London; pop. 20,045; named from Saxon King Edmund; ruins of old Benedictine abbey: map B-325
- Bus B-364-364a, pictures** B-364-364a
- government regulation I-198, B-364a
- trolley bus S-431, picture S-431
- types B-364c
- Busby, Richard** (1606-93), English schoolmaster, head of Westminster School; notorious for use of the birch; teacher of Dryden and Locke.
- Busch, Adolf (Georg Wilhelm)** (1891-1932), American violinist and composer, born Germany; younger brother of Fritz Busch; founded his quartet 1919; came to U. S. 1939; toured with son-in-law Rudolph Serkin, pianist, playing violin and piano sonatas.
- Busch, Fritz** (1890-1951), Argentine opera and orchestra conductor, born Germany; elder brother of Adolf Busch; won worldwide note as director Dresden Opera 1922-33; conductor Metropolitan Opera, New York City, 1945-51.
- Bush, Vanevar** (born 1890), electrical engineer, born Everett, Mass.; with Massachusetts Institute of Technology 1919-38; president Carnegie Institution after 1939; headed Office of Scientific Research and Development and the superconducting Research and Development Board of National Military Establishment 1910-48
- atomic power project, table A-464
- Bush.** See in *Index* Shrubs
- Bush,** remote, thinly settled interior of a country which has not been cleared for cultivation
- Australia A-482, picture A-479
- Bushel,** a unit of measure W-86, tables W-89, 87, 88
- Bushido** (*bû'shû-dô*), code of chivalry, feudal Japan J-318
- Bushman,** one of a people of South Africa A-43, S-242, map A-39, picture E-454, color picture A-55
- Bushmaster,** large, poisonous snake of the pit-viper family, *Crotalinae*; habitat, Central American and tropical South America.
- racial classification, chart R-22
- Stone Age E-456

Key: câpe, ât, fâr, fâst, whqt, îgll; mē, yēt, fērn, thêre; ice, bit; rōw, wōn, tōr, nōt, dg; cûre, bût, ryde, fûll, bârn; out;

Bush Negroes of *Guiana* C 223

Bush *David* (1742-1821) in ventor born *Baybrook* Conn built many propelled *submersibles* with which unsuccessful attempts were made to blow up British war ships during American Revolution called father of submarine S 477

Bushnell *Horace* (1807-76) theologian of wide influence born Litchfield Conn (Principles of Natural Greatness The Victorious Sacrifice)

Bush hit a small timonise T 140

Bushwhackers term for guerrilla fighters much used during Civil War for Southern sympathizers along border states

"Bushwhacking" in pulling boat up stream F 178

Business *Reverence* *William* D 299 30 See also in Index Accounting Advertising Banks and Banks Cooperative societies Copyright Corporations Credit Economic Fairs and expositions Finance Industry International trade Manufactures Market Panics and depressions Tariff Taxation Trade Trademarks Transportation Trusts and trusts and strikes by name For list of terms in economics table

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Business shift in population effect P 372-3

Business arbitration policy A 294

Business census of in US C 169

Business commercial revolution creates new methods T 165

Business insurance companies invest in chart I 168

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Business laissez faire doctrine I 130 133

Business Percentage and Interest P 144-5

Business pictures P 144 145 table P 145

Business Psychology in business P 428

Business stocks and bonds S 398-400 pictures S 398-9

Business and Professional Women's Clubs See in Index National Federation of Business and Professional Women's Clubs, Incorporated

Business conversation C 461

Business letters L 173-4

Business psychology P 428

Busiris (by a r i s) legendary king of ancient Egypt who to save his country from famine sacrificed each year a stranger to Zeus at tempted to sacrifice Hercules but was slain by him

Buskin Greek shoe T 112

Bussoli (bo so li) Ferruccio Benvenuto (1866-1924) pianist and composer born Italy of Italian father and German mother concert tours in Europe and US great piano technician (Lastspiel Opern Die Brautwahl opera)

Bussoli (bo so li) *Marcello* (born 1904) illustrator and writer born Berlin Germany of Italian father and Swedish mother in US after 1939 illustrated many children's books on geographical subjects wrote and illustrated *Somni* *Builds a Church* and *Stanley's Africa*

Bussy *Antoine* (1734-1837) chemist, born Paris France M 41

Bustard European and Asiatic bird B 371

Bustelli (by st li) *Frans* *Anton* (1723-63) Swiss potter born Locarno Switzerland P 297

Butadiene (bu ta di en) in synthetic rubber R 245 248

Butane plant at Houston Tex picture R 245

Butane hydrocarbon of paraffin series

found in Petroleum P 173 See also in Index Paraffin series

Butane isomers C 424a formulas diagram C 424a

Butane synthetic rubber R 245

Butcher antken gardens Victoria British Columbia Canada V 469

Butcher *Samuel Henry* (1850-1910) British classical scholar translated (with Andrew Lang) *Homer's* *Odyssey*

Butcher quoted G 210

Butcher *John* *Stuart* 1d earl of (1713-99) British statesman a supporter of royal autocracy

Butcher confidant of and privy counselor to George III prime minister 1762 63

Butcher (but e o) a genus of hawks M 242

Butler *Andrew Pickens* (1796-1857) US senator from South Carolina born Edgefield S C

Butler *Benjamin Franklin* (1813-93) US senator from South Carolina born Edgefield S C

Butler *Benjamin Franklin* (1813-93) US senator from South Carolina born Edgefield S C

Butler *Benjamin Franklin* (1813-93) US senator from South Carolina born Edgefield S C

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Butler *Benjamin Franklin* (1813-93) US senator from South Carolina born Edgefield S C

a Quaker family with Marine Corps 1894 1892 and fought in every campaign from Spanish American War to World War I

Butler *Sir William Francis* (1828-1910) British soldier and author born Sulistville County Tipperary Ireland in Canada 1867 73 where he took part in Red River expedition explored in Saskatchewan and the Rocky Mountains (The Great Lone Land The Wild Northland)

Butler *William Orlando* (1791 1880) general born Jessamine County Ky served in War of 1812 member of Congress 1839 43 commanded army in Mexico 1848

Butler *Pa* city 30 mi n of Pitts burgh in coal limestone natural gas and oil region pop 23 482 glass automobiles iron and steel products a broad car of well supplied rehned oil map P 132

Butler *University* at Indianapolis Ind chartered 1880 by Disciples of Christ as Northwestern Christian University arts and sciences business administration education music pharmacy religion

Butte *Mont* *Clara* (1875 1938) English singer with contralto voice of great range and power

Butte (bit) *Mont* city 47 mi s w of Helena pop 33 251 important copper mining and processing center zinc manganese and silver also produced livestock marketing phosphate chemicals Montana School of Mines M 367 377 maps M 374 U 232

Butte *Mont* *Clara* (1875 1938) English singer with contralto voice of great range and power

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tures P-420, I-158
metamorphosis B-367b-c, C-137-8,
picture B-367b, color pictures
B-365-7

moth, comparative characteristics
B-365

tropical, color picture B-367a

Butterfly bush. *See in Index* Buddle-
ia

Butterfly dog. *See in Index* Papillon

Butterfly fish, of family *Chaetodon-*
tidae; found in coastal waters and
coral reefs of the East and West
Indies; color picture O-334
morays and F-105

Butterfly flower. *See in Index* Schi-
zanthus

Butterfly stroke, in swimming S-473,
pictures S-472

Butterfly weed, or pleurisy root, a
perennial herb of the milkweed
family M-254

Buttermilk, table M-252

Butternut, or white walnut, a tree
B-369

Butterwort, a genus (*Pinguicula*) of
small perennials of the bladderwort
family growing in damp places has
broad fleshy leaves greasy to the
touch; flowers solitary, white to
purple, and yellow

Butterworth, Ezekiah (1839-1905),
writer of children's stories and
verses, born Warren R I ('Zig-
Zag Journeys')

Butt joint. *See in Index* Architecture,
table of terms

Button, Sir Thomas (died 1634),
English navigator led an expedi-
tion in search of Northwest Passage
1612-13

Manitoba M-80

Button B-369-72, pictures B-370-2

Buttonbush, a shrub of the genus
Cephalanthus of the madder family
has pointed oblong leaves, opposite
or in whorls of 3, fragrant small
white flowers in globular heads.

Button. Button, Who's Got the
Button?, a game G-8d

Button clover C-360

Buttonholes

how to make S-114
sewing-machine attachment, picture
S-116

Buttonhole stitch, in sewing S-112, dia-
gram S-111

Button lace L-82

Button snakeroot. *See in Index* Liatris

Buttonwood, or sycamore S-486

Buttress, in architecture A-317, pic-
ture M-159. *See also in Index* Archi-
tecture, table of terms

Buttress A-316, 317, pictures
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Butyl, combining radical (C₄H₉) of
butane.

Butyl acetate, a solvent, formed of
butyl and ethyl linked by CO₂
laquer L-82

Butyl alcohol, a compound (C₄H₉OH)
of hydroxyl and butyl
bacteria produce B-15
-solvent L-82

Butyl rubber R-245

Butyric (bū'tī'rik) acid, an organic
compound (C₄H₇COOH) which gives
odor to rancid butter F-52

Buxaceae. *See in Index* Box family

Buzzard. *See in Index* Vulture

Buzzard hawk H-292

Buzzards Bay, Mass., an inlet of the
Atlantic on the S. coast of Massa-
chusetts. maps M-124, 133
Cape Cod Canal C-118, C-108b, pic-
ture M-135

BYZANTINE RULERS

Under Diocletian (A.D. 284), the Roman Empire was divided into the Eastern Empire and the Western Empire, but it was not until the death of Theodosius (A.D. 395) that the two were finally separated. The name "Byzantine" applies to the Eastern Empire from that time on. For Eastern rulers preceding Arcadius, see in *Index* Rome. Emperors of, table. In this table overlapping dates indicate co-rulers, except in the case of the Latin Emperors who, during the Crusades, were set up as rivals to the Nicæan Emperors.

| | | | |
|----------|-------------------------------------|-----------|-----------------------------------|
| 395-408 | Arcadius | 1028-34 | Romanus III, Argyropoulos |
| 408-450 | Theodosius II | 1034-41 | Nicetas IV, the Paphla- gonian |
| 450-457 | Marcianus | 1041-42 | Nicetas V, Kalaphates |
| 457-474 | Leo I | 1042-51 | Constantine IX, Mono- machus |
| 474 | Leo II | | |
| 474-491 | Zeno | 1054-56 | Theodore |
| 491-518 | Anastasius I | 1056-57 | Michael VI, Stratioticus |
| 518-527 | Justinian I | 1057-59 | Isaac I, Comnenus |
| 527-565 | Justinian I | 1059-67 | Constantine X, Dukas |
| 565-578 | Justinian II | 1067 | Andronicus |
| 578-582 | Tiberius, Constantinus | 1067 | Constantine XI |
| 582-602 | Mauritius | 1067-71 | Romanus IV, Diogenes |
| 602-610 | Phocas I | 1071-78 | Michael VII, Parapinakes |
| 610-641 | Heraclius I | 1078-81 | Nicephorus III, Botaniates |
| 641 | Constantine III | 1081-1118 | Alexius I, Comnenus |
| 641 | Heraclion | 1118-43 | John IV, Calus |
| 641-668 | Constant II | 1143-80 | Manuel I |
| 668-685 | Constantine IV | 1180-83 | Alexius II |
| 685-695 | Justinian II | 1182-85 | Andronicus I |
| 695-698 | Leo VI | 1185-95 | Isaac II, Angelus-Comnenus |
| 698-705 | Tiberius III, Apimair | 1195-1203 | Alexius III, Angelus |
| 705-711 | Justinian II (restored) | 1203-4 | Alexius IV |
| 711-713 | Philippicus | 1204 | Alexius V, Dukas |
| 713-715 | Anastasius II | | |
| 715-717 | Theodosius III | | |
| 717-741 | Leo III, the Isaurian | | |
| 741-775 | Constantine V, Kopronymus | | |
| 775-780 | Leo IV | | |
| 780-797 | Constantine VI | | |
| 797-802 | Irene | | |
| 802-811 | Nicephorus I | | |
| 811 | Nicetas | | |
| 811-813 | Michael I, Rhangabé | | |
| 813-820 | Leo V, the Armenian | | |
| 820-829 | Michael II | | |
| 829-842 | Theophilus I | | |
| 842-867 | Michael III | | |
| 867 | Bardas | | |
| 867-886 | Theophilus II | | |
| 886-896 | Basil I, the Macedonian | | |
| 896-912 | Leo VI, the Wise | | |
| 912-913 | Alexander III | | |
| 913-959 | Constantine VII, Porphyrogenitus | | |
| 959-963 | Romanus I, Lecapenus | | |
| 963-1025 | Romanus II | | |
| 963-969 | Basil II, Bulgaroktonos | | |
| 969-976 | Nicephorus II, Phocas | | |
| 976-978 | John I, Tzimiskes | | |
| 1025-28 | Constantine VIII | | |
| 1028-30 | Zoe | | |

Latin Emperors

| | |
|---------|---------------------|
| 1204-5 | Baldwin I |
| 1205-16 | Henry VI |
| 1216-17 | Peter de Courtenay |
| 1218-28 | Robert de Courtenay |
| 1228-61 | Baldwin II |

Nicæan Emperors

| | |
|---------|-----------------------|
| 1206-22 | Theodore I, Lascaris |
| 1222-51 | John Dukas Vatatzes |
| 1251-59 | Theodore II, Lascaris |
| 1258-61 | John IV, Lascaris |

The Paleologs

| | |
|-----------|------------------------|
| 1261-82 | Michael VIII |
| 1282-1328 | Andronicus II |
| 1293-1320 | Michael IX |
| 1328-41 | Andronicus III |
| 1341-47 | John V |
| 1347-54 | John VI, Cantacuzene |
| 1355-76 | John V (restored) |
| 1376-79 | Andronicus IV |
| 1379-91 | John V (restored) |
| 1390 | John VII |
| 1391-1425 | Manuel II |
| 1425-48 | John VIII |
| 1448-53 | Constantine XI or XIII |

lift bridge B-308. *See also in Index*
Bridge, table

Buz bomb. *See in Index* V-bombs

Byblos (bīb'lōs), ancient city on site
of modern Jebel in Lebanon on
Mediterranean coast 25 mi. n.e. of
Beirut; called Gebal in Bible; early
center of Phoenician civilization;
valuable remains of Egyptian oc-
cupation in 14th century B.C.; later
chief fortress of Philistines until
their defeat by Israelites.

Bydgoszcz (bī'dgō'shtch), or Brom-
berg (brōm'bē'rk), Poland, city on
canal between Oder and Vistula
rivers; formerly in province of
Posen, Prussia; pop. 159,836; trade
center: maps E-416, 424

Byelinsky, or Belinsky (bēl-in'-skē),
Vissarion Grigorevich (1810-48),
Russian critic and philosopher.

Bye-Lo Baby, a doll D-122

Byelorussia. *See in Index* White Rus-
sian (Byelorussian) Soviet Social-
ist Republic

Byelinka, mountain, Siberia. *See in*
Index Belukha

Byely (bē'lē), or Bely, Andrey, pen
name of Boris Nikolaevich Bugaiev
(bō-gū'yēf) (1880-1934), Russian
mystic poet and novelist ('Peters-
burg'; 'The Urn'); R-295

Byerly Turk, horse, foundation sire of
the Thoroughbred Horse H-428d,
table H-428c

'Byerbozhnik' ('The Godless'). Rus-
sian antireligious journal R-272

By-law, a rule or regulation made by
a society or organization (incorpo-
rated or unincorporated) for its
government P-89

Byng (Ving), Julian Hedworth George,
first viscount of Vimy (1862-
1935), British general and states-
man; served in Boer War and
in World War I; commanded
Canadian Corps at Vimy Ridge;
governor general of Canada 1921-
26; chief commissioner London
police 1928-31.

Byn'ner, Witter (horn 1881), poet,
born Brooklyn, N. Y.; later lived
in Santa Fé, N. M.; verse facile
and varied; in 'Indian Earth'
interpreted Indian life in the
Southwest; translated and com-
piled 'The Jade Mountain', Chinese
anthology (with Kiang Kang-Hu).

By-pass condensers, in radio R-39,
diagram R-35

By-product, a secondary product, es-
pecially a product obtained as part
of the manufacture of another
product

agricultural P-304; corn C-484-5,
diagram C-483; cotton C-495;
soybean M-73; sugar beet S-446;
sugar cane S-446, picture P-200
alum A-181

byer: cūpe, āt, fār, fāst, whqt, fāll; mē, yčt, fērn, thēre; ice, bit; rōw, wōn, fōr, nōt, dō; cūre, būt, ryde, fyll, būrn; out;

armorum sulfate F 53
 cacao bean husks C 288
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 fly ash See in Index Fly ash
 glycerin G 127
 hair H 243
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 feather L-14v
 Leblanc soda process S 226
 lignin F 67 W 187
 lumber P 304 L 350
 meat packing M 154-5 G 127 hog
 H 403
 milk M 253 pictures M 253
 paper mill wastes P 71
 selenium S 98
 silver S 188
 whale W 114
Byrd Richard Evelyn (born 1886)
 American aviator and explorer
 B 373
 Antarctic exploration B 373 P 351
 A 258 261 pict res P 347 348
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 North Pole exploration B 373 map
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 transatlantic flight B 373
Byrd William (1674-1744) lawyer
 born Westover Va founder of
 Richmond and Petersburg Va
 R 152
 writings A 225-6 quoted A 226
Byrd or Birde William (1542-1623)
 English organist and composer born

London noted for church music
 one of founders of English Madrigal
 school
Byrne Donn (Brian Oswald Donn
 Byrne) (1889-1928) Irish Ameri-
 can novelist and short story writer
 born New York City of Irish par-
 ents spent childhood and youth in
 Ireland storytelling power to
 create atmosphere and undercur-
 rent of humor (Messer Marco
 Polo The Wind Blows Blind
 Hafferty Hangman's House)
Byrnes James Francis (born 1879)
 lawyer and public official born
 Charleston SC U S representa-
 tive 1911-23 U S senator 1931-41
 associate justice U S Supreme
 Court 1941-42 director Office of
 Economic Stabilization 1942-43
 director war mobilization 1943-45
 secretary of state 1945-47 elected
 governor of South Carolina 1951
 appointed member of U S delega-
 tion to United Nations Sept 1953
 ("speaking Frankly")
Byron George Gordon Lord (1788-
 1824) English poet B 373 E 380
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development of dome A 310 picture
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 Mosque of Sultan Achmet pictures
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Byzantine Empire also called Eastern
 Empire or Greek Empire B 373-4
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 Constantinian founds Constantinople
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 Crusaders succeed in conquest (1064)
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 of Vandals by Belisarius V 438
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 Turks take Constantinople (1453)
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 Greek city on site of Istanbul C 458
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